Agilent 3499A/B Switch/Control System

Service Manual

Agilent Technologies

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Agilent 3499A/B Switch/Control System Service Manual

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AGILENT TECHNOLOGIES WARRANTY STATEMENT

PRODUCT: Agilent 3499A/B Switch/Control System **DURATION OF WARRANTY:** 1 years

1. Agilent Technologies warrants Agilent hardware, accessories and supplies against defects in materials and workmanship for the period specified above. If Agilent receives notice of such defects during the warranty period, Agilent will, at its option, either repair or replace products which prove to be defective. Replacement products may be either new or like-new.

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Agilent 3499A/B Switch/Control System Service Manual
Edition 1
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Documentation History

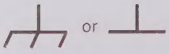
All Editions and Updates of this manual and their creation date are listed below. The first Edition of the manual is Edition 1. The Edition number increments by 1 whenever the manual is revised. Updates, which are issued between Editions, contain replacement pages to correct or add additional information to the current Edition of the manual. Whenever a new Edition is created, it will contain all of the Update information for the previous Edition. Each new Edition or Update also includes a revised copy of this documentation history page.

Edition 1 (03499-90002) . . . . . January 2000

Safety Symbols

Instruction manual symbol affixed to product. Indicates that the user must refer to the manual for specific WARNING or CAUTION information to avoid personal injury or damage to the product.

Indicates the field wiring terminal that must be connected to earth ground before operating the equipment—protects against electrical shock in case of fault.



Frame or chassis ground terminal—typically connects to the equipment's metal frame.

Alternating current (AC)

Direct current (DC).

Indicates hazardous voltages.

WARNING Calls attention to a procedure, practice, or condition that could cause bodily injury or death.

CAUTION Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.

WARNINGS

The following general safety precautions must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. Agilent Technologies Company assumes no liability for the customer's failure to comply with these requirements.

Ground the equipment: For Safety Class 1 equipment (equipment having a protective earth terminal), an uninterruptible safety earth ground must be provided from the mains power source to the product input wiring terminals or supplied power cable.

DO NOT operate the product in an explosive atmosphere or in the presence of flammable gases or fumes.

For continued protection against fire, replace the line fuse(s) only with fuse(s) of the same voltage and current rating and type. DO NOT use repaired fuses or short-circuited fuse holders.

Keep away from live circuits: Operating personnel must not remove equipment covers or shields. Procedures involving the removal of covers or shields are for use by service-trained personnel only. Under certain conditions, dangerous voltages may exist even with the equipment switched off. To avoid dangerous electrical shock, DO NOT perform procedures involving cover or shield removal unless you are qualified to do so.

DO NOT operate damaged equipment: Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to a Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

DO NOT service or adjust alone: Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT substitute parts or modify equipment: Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the product. Return the product to a Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

Operating Location: Sheltered location where air temperature and humidity are controlled within this product's specifications and the product is protected against direct exposure to climatic conditions such as direct sunlight, wind, rain, snow, sleet, and icing, water spray or splash, hoarfrost or dew. (Typically, indoor.) Pollution environment for which this product may be operated is IEC 664 Pollution degree

WARNINGS (Cont.)

The Agilent 3499A/B can have modules that are capable of switching voltages up to 250V maximum. Voltage levels above the levels specified for accessible connectors or cable ends could cause bodily injury or death to an operator. Special precautions must be adhered to (discussed below) when applying voltages in excess of 60 Vdc, 30 Vac rms or 42.4 Vac peak.

Module connectors and test signal cables connected to them cannot be operator accessible. Cables and connectors are considered inaccessible if a tool (e.g., screwdriver, wrench, socket, etc.) or a key (equipment in a locked cabinet) is required to gain access to them. Additionally, the operator cannot have access to a conductive surface connected to any cable conductor (High, Low or Guard).

Assure the equipment under test has adequate insulation between the cable connections and any operator-accessible parts (doors, covers, panels, shields, cases, cabinets, etc.). Verify there are multiple and sufficient protective means (rated for the voltages you are applying) to assure the operator will NOT come into contact with any energized conductor even if one of the protective means fails to work as intended. For example, the inner side of a case, cabinet, door, cover or panel can be covered with an insulating material as well as routing the test cables to the module's front panel connectors through non-conductive, flexible conduit such as that used in electrical power distribution.

This ISM device complies with Canadian CES-001
Cet appareil ISM est conforme à la norme NMB-001 du Canada

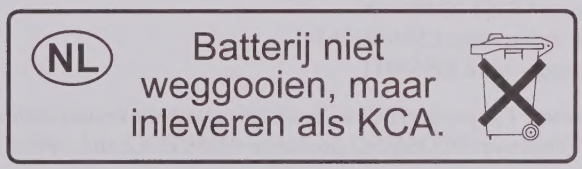
CLEANING INFORMATION

The instrument should only be cleaned by wiping it with a soft damp cloth.

BATTERY DISPOSAL

This product contains a nickel-cadmium battery. Please recycle or dispose of in accordance with all applicable Federal, State and Local laws

DUTCH BATTERY DISPOSAL WARNING



Declaration of Conformity

according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name: Agilent Technologies Co., Ltd.
China Test & Measurement Operation

Manufacturer's Address: #4 Hua Yuan Road, Haidian District
Beijing 100088, PRC

Declares, that the product:

Product Name: Switch/Control System

Model Number: Agilent 3499A/B

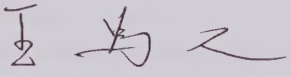
Product Options: All

Conforms to the following product specifications:

Safety: IEC 61010-1 (1990)+A1:1992+A2:1995/EN61010-1:1993+A2:1995
CSA C22.2 #1010.1:1993
UL 3111-1

EMC: IEC61326-1+A1:1998/EN61326-1+A1:1998
Canada ICES-001
Australia AS/NZS/2064
Russia GOST 23450-79
Czech Republic CSN EN55011
Hungary MSZ EN55011

Supplementary Information: The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (inclusive 93/68/EEC) and carries the "CE" mark accordingly.



September, 1999

Weiren Wang, QA Manager

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Chapter 1
Specifications

General Information

The Agilent 3499 Switch/Control System is composed of two mainframes and a set of plug-in modules. This chapter lists the specifications of the two Agilent 3499A/B mainframes and all the plug-in modules. These include:

- Agilent 3499A/B Mainframes Specifications . . . . . Page 2
- Multiplexer (MUX) Modules Specifications . . . . . Page 3
- GP Relay Modules Specifications. . . . . Page 4
- Matrix Modules Specifications . . . . . Page 6
- Digital I/O Modules Specifications. . . . . Page 7
- Agilent 44472A VHF Switch Module Specifications. . . . . Page 8
- Agilent 44475A Breadboard Module Specifications . . . . . Page 9
- Agilent 44476A Microwave Switch Module Specifications Page 9
- Agilent 44477A Form_C Relay Module Specifications . . . . Page 10
- Agilent 44478A/B 1.3 GHz MUX Modules Specifications . Page 11

Agilent 3499A/B Mainframes Specifications

ITEMS	SPECIFICATIONS
General	
Power Supply:	100 to 240 VAC universal input; 47 Hz to 440 Hz; 40 VA maximum.
Operating Environment:	0 to 55°C (32 to 131°F); < 80% RH, 0 to 40°C (32 to 104°F).
Storage Environment:	-40 to +70°C (-40 to 158°F)
Net Weight:	Agilent 3499A: 3.8 kg (8.4 bs); Agilent 3499B: 2.5 kg (5.5 bs).
Dimensions:	Agilent 3499A (H x W x L): 89mm x 426mm x 348mm (3.5" x 16.8" x 13.7"); Agilent 3499B (H x W x L): 89mm x 213mm x 348mm (3.5" x 8.4" x 13.7").
Safety:	Conforms to CSA, UL-1244, IEC 1010 Cat I.
RFI and ESD:	CISPR 11, IEC 801/2/3/4.
System	
Capacity:	5 Slots (Agilent 3499A) or 2 Slots (Agilent 3499B).
Display:	Vacuum fluorescent, 13 characters can be displayed simultaneously.
Rear Panel Connectors:	GPIB (IEEE-488); RS-232; 8-pin Mini DIN connector (4-bit Digital I/O, external triggers).
Memory:	Battery backed, 4-year typical life (below 40 °C); Capable of storing 10 instrument setups and 10 errors (in SCPI mode) or 40 instrument setups and 1 error (in HP 3488A mode).
Switch Setting Time:	Automatically selected by the mainframe for individual modules; Additional time from 0 to 99999.999 seconds can be added in 1 ms steps.
Arm Source:	External trigger (from the rear panel Mini DIN connector); IEEE-488 bus (GET, *TRG, or pressing **Step** from the front-panel); Software (TRIGger:IMM); Internal timer (programmable as 0 to 99999.999 seconds in 1 ms steps).
Trigger Source:	External trigger (from the rear panel Mini DIN connector); IEEE-488 bus (GET, *TRG, or pressing **Step** from the front-panel); Software (Trigger:IMM); Internal timer (programmable as 0 to 99999.999 seconds in 1 ms steps).
External Trigger Input:	Level: TTL compatible; Minimum trigger pulse width: 2 µs; Maximum external trigger delay[a]: 2 ms.
External Trigger Output:	Level: Normally pull up to 5 V; Sink current: 10 mA @ V_o(Low) ≤ 0.4V; 80 mA @ V_o(Low) ≤ 0.8V; Low going pulse width: 10 µs typical.
Built-in 4-bit Digital I/O:	Input: TTL compatible; Output: V_o(high) ≥ 2.4V @ I_o = 1 mA; V_o(Low) ≤ 0.8V @ I_o = −100 mA; Maximum V_o = 42V, with external pull-up.
System Speed	
Scan Speed:	80 chans/sec (N2260A)
Parser Time[b]:	Open (@100): 3 ms; Close (@100): 3 ms; Open (@100:139): 4 ms
Switching Speed:	Channels / Time (ms) Open/Close: 1 — 8.3 (N2260A) Open/Close: 10 — 18.8 (N2260A, in the same group) Open/Close: 40 — 42.0 (N2260A) *SAV/*RCL: 200 — 76.0 (N2260A)
Digital I/O Block Transfer Rate:	20K bytes/sec (long word)

a. Maximum time from activation of external trigger pulse to start of switch open or close.
b. Measured from the time at which the command terminator is taken from the bus to the time at which the relay begins to open or close.

Plug-in Modules Specifications

Multiplexer (MUX) Modules

The MUX modules available with Agilent 3499A/B include: Agilent N2260A 40-channel MUX, Agilent 44470A/D 10/20-channel MUXs. The specifications of the MUX modules are listed in the table below.

ITEMS		SPECIFICATIONS		
		Agilent N2260A	Agilent 44470A	Agilent 44470D
INPUT CHARACTERISTICS				
Total Channels:		80 1-wire; or 40 2-wire; or dual 20 2-wire; or 20 4-wire	10 (2-wire)	20 (2-wire)
Maximum Voltage	Terminal-Terminal or Terminal-Chassis:	200 V, dc or ac rms	250 V, dc or ac rms	250 V, dc or ac rms
Maximum Current	Per Channel:	1 A, dc or ac rms	2 A, dc or ac rms	2 A, dc or ac rms
	Per Module:	2A, dc or ac rms	2 A, dc or ac rms	2 A, dc or ac rms
Maximum Power	Per Channel:	60 W dc; 62.5 VA ac	60 W dc; 500 VA ac	60 W dc; 125 VA ac
	Per Module:	120 W dc; 125 VA ac	60 W dc; 500 VA ac	60 W dc; 125 VA ac
Maximum Overvoltage Transients:		N/A	1400 V_{pk}	1400 V_{pk}
Thermal Offset:		< 3 µV	< 3 µV differential or single-ended	< 3 µV differential or single-ended
Initial Closed Channel Resistance:		< 1 Ω	< 1 Ω	< 1 Ω
Relay Life:		Mechanical: 10^8 (at 36000 operations/hour) Electrical: 5 x 10^5 (1A load)	10^8 (dry load of < 300 mA & < 10 V) 10^5 (maximum rated load)	
Maximum Scan Rate:		80 Chans/sec	43 Chans/sec	43 Chans/sec
DC ISOLATION (with terminal block)				
Open Channel, Channel-Channel (with 1 channel closed)		< (40°C, 50% RH): > 10^{10} Ω < (40°C, 80% RH): > 10^9 Ω	< (40°C, 60% RH): > 10^{11} Ω < (40°C, 95% RH): > 10^9 Ω	< (40°C, 60% RH): > 10^{11} Ω < (40°C, 95% RH): > 5x10^9 Ω
HI-LO (with 1 channel closed)		< (40°C, 50% RH): > 10^{10} Ω < (40°C, 80% RH): > 10^9 Ω	< (40°C, 60% RH): > 10^{10} Ω < (40°C, 95% RH): > 10^8 Ω	< (40°C, 60% RH): > 5x10^{10} Ω < (40°C, 95% RH): > 10^9 Ω
Channel-Chassis (with 1 channel closed)		< (40°C, 50% RH): > 10^{10} Ω < (40°C, 80% RH): > 10^9 Ω	< (40°C, 60% RH): > 10^{10} Ω < (40°C, 95% RH): > 5x10^8 Ω	< (40°C, 60% RH): > 5x10^{10} Ω < (40°C, 95% RH): > 10^9 Ω
AC ISOLATION / PERFORMANCE[a] (without terminal block)				
Capacitance (with 1 channel closed)	Open Channel, Channel-Channel:	< 7 pF (2-wire) < 7 pF (dual 2-wire)	< 5 pF	< 7 pF
	HI-LO:	< 75 pF (2-wire) < 45 pF (dual 2-wire)	< 27 pF	< 27 pF
	Channel-Chassis:	< 150 pF (2-wire) < 90 pF (dual 2-wire)	< 80 pF	< 80 pF
Insertion Loss (with 50Ω termination)	100 kHz:	< 0.10 dB	< 0.20 dB	< 0.20 dB
	1 MHz:	< 0.20 dB	< 0.25 dB	< 0.25 dB
	10 MHz:	< 1.50 dB	< 0.50 dB	< 1.20 dB
Crosstalk (with 50Ω termination)	100 kHz:	< -70 dB (2-wire) < -40 dB (1-wire)	< -73 dB	< -73 dB
	1 MHz:	< -50 dB (2-wire) < -25 dB (1-wire)	< -53 dB	< -53 dB
	10 MHz:	< -30 dB (2-wire) N/A (1-wire)	< -33 dB	< -31 dB

a. With chassis of all instruments connected, and with the Low Terminal of the input connected to the Low Terminal of the output (either directly or via Agilent 3499A/B switching channels).

GP Relay Modules

The General Purpose (GP) relay modules include: Agilent N2261A 40-channel GP relays, Agilent 44471A/D 10/20-channel GP relays, and the GP relays on an Agilent N2264A. The specifications of the Agilent N2261A, 44471A/D are listed in the table below.

ITEMS		SPECIFICATIONS		
		Agilent N2261A	Agilent 44471A	Agilent 44471D
INPUT CHARACTERISTICS				
Total Channels:		40	10	20
Maximum Voltage	Terminal-Terminal or Terminal-Chassis:	200 V, dc or ac rms	250 V, dc or ac rms	250 V, dc or ac rms
Maximum Current	Per Channel: Per Module:	1 A, dc or ac rms 20 A, dc or ac rms	2 A, dc or ac rms 20 A, dc or ac rms	1A, dc or ac rms 20 A, dc or ac rms
Maximum Power	Per Channel: Per Module:	60 W dc; 62.5 VA ac 1200 W dc; 1250 VA ac	60 W dc; 500 VA ac 600 W dc; 5000 VA ac	60 W dc; 125 VA ac 1200 W dc; 2500 VA ac
Maximum Overvoltage Transients:		N/A	1400 V_{pk}	1400 V_{pk}
Thermal Offset	Per Channel:	< 3 µV	< 3 µV different or single-ended	< 3 µV different or single-ended
Initial Closed Channel Resistance:		< 0.5 Ω	< 1 Ω	< 1 Ω
Relay Life		Mechanical: 10^8 (at 36000 operations/hour) Electrical: 5 x 10^5 (1A load)	10^8 operations/chan (dry load of < 300 mA & < 10 V) 10^5 operations/chan (maximum rated load)	10^8 operations/chan (dry load of < 300 mA & < 10 V) 10^5 operations/chan (maximum rated load)
Maximum Scan Rate:		80 Chans/sec	43 Chans/sec	43 Chans/sec
DC ISOLATION (with terminal block)				
Open Channel, Channel-Channel (with 1 channel closed)		< (40°C, 50% RH): > 10^{10} Ω < (40°C, 80% RH): > 10^9 Ω	< (40°C, 60% RH): > 10^{11} Ω < (40°C, 95% RH): > 10^9 Ω	< (40°C, 60% RH): > 10^{11} Ω < (40°C, 95% RH): > 10^9 Ω
Channel-Chassis (with 1 channel closed)		< (40°C, 50% RH): > 10^{10} Ω < (40°C, 80% RH): > 10^9 Ω	< (40°C, 60% RH): > 5x10^{11} Ω < (40°C, 95% RH): > 10^{10} Ω	< (40°C, 60% RH): > 5x10^{11} Ω < (40°C, 95% RH): > 10^{10} Ω
AC ISOLATION / PERFORMANCE[a] (without terminal block)				
Capacitance (with 1 channel closed)	Open Channel: Channel-Channel: Channel-Chassis:	< 10 pF < 10 pF < 20 pF	< 7 pF < 10 pF < 25 pF	< 7 pF < 10 pF < 25 pF
Insertion Loss (with 50Ω termination)	100 kHz: 1 MHz: 10 MHz:	< 0.10 dB < 0.20 dB < 0.50 dB	< 0.20 dB < 0.25 dB < 0.50 dB	< 0.20 dB < 0.25 dB < 1.00 dB
Crosstalk (with 50Ω termination)	100 kHz: 1 MHz: 10 MHz:	< -70 dB < -50 dB < -30 dB	< -73 dB < -53 dB < -33 dB	< -71 dB < -51 dB < -31 dB

a. With chassis of all instruments connected, and with Low Terminal of the input connected to Low Terminal of the output (either directly or via Agilent 3499A/B switching channels)

The specifications of the GP relays on an Agilent N2264A are listed in the table below.

ITEMS		SPECIFICATIONS	
		Agilent N2264A[a] (12-Channel GP function)	Agilent N2264A (3-Channel High-current GP function)
INPUT CHARACTERISTICS			
Total Channels:		12	3
Maximum Voltage	Terminal-Terminal or Terminal-Chassis:	200 V, dc or ac rms	125 V dc or 200 V ac rms
Maximum Current	Per Channel:	1 A, dc or ac rms	5A, dc or ac rms
Maximum Power	Per Channel:	60 W dc; 62.5 VA ac	150 W dc; 1250 VA ac
Thermal Offset	Per Channel:	< 3 μV	< 3 μV
Initial Closed Channel Resistance:		< 0.5 Ω	< 0.1 Ω
Relay Life		10^8 (at 36000 operations/hour) 5 x 10^5 (1A load)	5 x 10^7 (at 180 cycles/minute) 10^5 (at rated load)
Maximum Scan Rate:		80 Chans/sec	N/A
Time to Close One Channel:		N/A	16 ms
DC ISOLATION (with terminal block)			
Open Channel, Channel-Channel (with 1 channel closed)		< (40°C, 50% RH): > 10^{10} Ω < (40°C, 80% RH): > 10^9 Ω	< (40°C, 50% RH): > 10^{10} Ω < (40°C, 80% RH): > 10^9 Ω
Channel-Chassis (with 1 channel closed)		< (40°C, 50% RH): > 10^{10} Ω < (40°C, 80% RH): > 10^9 Ω	< (40°C, 50% RH): > 10^{10} Ω < (40°C, 80% RH): > 10^9 Ω
AC ISOLATION / PERFORMANCE[b] (without terminal block)			
Capacitance (with 1 channel closed)	Open Channel: Channel-Channel: Channel-Chassis:	< 10 pF < 10 pF < 20 pF	< 10 pF < 10 pF < 20 pF
Insertion Loss (with 50Ω termination)	100 kHz: 1 MHz: 10 MHz:	< 0.10 dB < 0.20 dB < 0.50 dB	< 0.10 dB < 0.20 dB < 0.50 dB
Crosstalk (with 50Ω termination)	100 kHz: 1 MHz: 10 MHz:	< -70 dB < -50 dB < -30 dB	< -70 dB < -50 dB < -30 dB

a. Agilent N2264A combines a 12-channel GP, a 3-channel high-current GP and a 16-bit digital I/O into one module. It can be operated as three separate modules.

b. With chassis of all instruments connected, and with Low Terminal of the input connected to Low Terminal of the output (either directly or via Agilent 3499A/B switching channels)

Matrix Modules

The matrix modules include: Agilent N2262A 4 x 8 2-wire matrix, Agilent 44473A 4 x 4 2-wire matrix and the 4 x 4 2-wire matrix on an Agilent N2265A. The specifications are listed in the table below.

ITEMS		SPECIFICATIONS		
		Agilent N2262A	Agilent N2265A[a] (4 x 4 Matrix)	Agilent 44473A
INPUT CHARACTERISTICS				
Total Channels:		4 x 8	4 x 4	4 x 4
Maximum Voltage	Terminal-Terminal or Terminal-Chassis:	200 V, dc or ac rms	200 V, dc or ac rms	250 V, dc or ac rms
Maximum Current	Per Channel: Per Module:	1 A, dc or ac rms 4 A, dc or ac rms	1 A, dc or ac rms 4 A, dc or ac rms	2 A, dc or ac rms 8 A, dc or ac rms
Maximum Power	Per Channel: Per Module:	60 W dc; 62.5 VA ac 240 W dc; 250 VA ac	60 W dc; 62.5 VA ac 240 W dc; 250 VA ac	60 W dc; 500 VA ac 240 W dc; 2000 VA ac
Maximum Overvoltage Transients		N/A	N/A	1400 V_{pk}
Thermal Offset:		< 3 µV differential	< 3 µV differential	< 3 µV differential
Initial Closed Channel Resistance:		< 1 Ω	< 1 Ω	< 1 Ω
Relay Life		Mechanical: 10^8 (at 36000 operations/hour) Electrical: 5 x 10^5 (1A load)	Mechanical: 10^8 (at 36000 operations/hour) Electrical: 5 x 10^5 (1A load)	10^8 operations/chan (dry load of < 300 mA & < 10 V) 10^5 operations/chan (maximum rated load)
Maximum Scan Rate:		80 Chans/sec	80 Chans/sec	43 Chans/sec
DC ISOLATION (with terminal block)				
Open Channel, Channel-Channel (with 1 channel closed)		< (40°C, 50% RH): > 10^{10} Ω < (40°C, 80% RH): > 10^9 Ω	< (40°C, 50% RH): > 10^{10} Ω < (40°C, 80% RH): > 10^9 Ω	< (40°C, 60% RH): > 10^{11} Ω < (40°C, 95% RH): > 10^9 Ω
HI-LO (with 1 channel closed)		< (40°C, 50% RH): > 10^{10} Ω < (40°C, 80% RH): > 10^9 Ω	< (40°C, 50% RH): > 10^{10} Ω < (40°C, 80% RH): > 10^9 Ω	< (40°C, 60% RH): > 10^{10} Ω < (40°C, 95% RH): > 10^8 Ω
Channel-Chassis (with 1 channel closed)		< (40°C, 50% RH): > 10^{10} Ω < (40°C, 80% RH): > 10^9 Ω	< (40°C, 50% RH): > 10^{10} Ω < (40°C, 80% RH): > 10^9 Ω	< (40°C, 60% RH): > 10^{10} Ω < (40°C, 95% RH): > $5x10^8$ Ω
AC ISOLATION / PERFORMANCE[b] (without terminal block)				
Capacitance (with 1 channel closed)	Open Channel, Channel-Channel: HI-LO: Channel-Chassis:	 < 7 pF < 30 pF < 50 pF	 < 7 pF < 25 pF < 40 pF	 < 5 pF < 40 pF < 70 pF
Insertion Loss (with 50Ω termination)	100 kHz: 1 MHz: 10 MHz:	< 0.10 dB < 0.20 dB < 0.60 dB	< 0.10 dB < 0.20 dB < 0.60 dB	< 0.30 dB < 0.35 dB < 0.90 dB
Crosstalk (with 50Ω termination)	100 kHz: 1 MHz: 10 MHz:	< -73 dB < -53 dB < -28 dB	< -76 dB < -56 dB < -33 dB	< -76 dB < -56 dB < -36 dB

a. Agilent N2265A combines a 4 x 4 matrix and a 16-bit digital I/O into one module. It can be operated as two separate modules.

b. With chassis of all instruments connected, and with Low Terminal of the input connected to Low Terminal of the output (either directly or via Agilent 3499A/B switching channels).

Digital I/O Modules

The digital I/O modules available with Agilent 3499A/B include: Agilent N2263A 32-bit digital I/O, Agilent 44474A 16-bit digital I/O module and the 16-bit digital I/O on both the Agilent N2264A/65A multifunction modules. The specifications are listed in the table below.

ITEMS		SPECIFICATIONS	
		Agilent N2263A/64A/65A[a]	Agilent 44474A
I/O LINES			
Bit Number:		32/16/16	16
Maximum Voltage	Line-Chassis:	+ 42 V dc	+ 30 V dc
Maximum Sink Current	Per Bit:	600 mA	125 mA
Output Characteristics	Vout (high): Vout (low): I (low):	≥ 2.4 V @ I ≤ 10 mA output ≤ 0.8 V @ I ≤ 600 mA input N/A	≥ 2.4 V @ I ≤ 8 mA output ≤ 0.4 V @ I ≤ 16 mA input = 125 mA @ Vout (low) ≤ 1.25 V I (low) is fused at 250 mA
Input Characteristics	Vin (high): Vin (low):	≥ 2.0 V ≤ 0.8 V	≥ 2.0 V ≤ 0.8 V
HANDSHAKE LINES			
Maximum Voltage	Line-Chassis:	+ 5 V dc	+ 5 V dc
Output Characteristics	Vout (high): Vout (low): Iout (low):	≥ 2.4 V @ I ≤ 400 µA output ≤ 0.5 V @ I ≤ 1 mA input < 25 mA (when shorted to +5 V)	≥ 2.4 V @ I ≤ 400 µA output ≤ 0.5 V @ I ≤ 2 mA input N/A
Input Characteristics	Vin (high): Vin (low):	≥ 2.0 V ≤ 0.8 V	≥ 2.0 V ≤ 0.8 V
External Increment (EI)[b]:		N/A	Advance Agilent 3499A to next programmed configuration on falling edge of TTL pulse, 0.25 µsec minimum width.
Channel Closed (CC)[c]:		N/A	Indicates completion of new configuration; TTL pulse, 10 µsec minimum width.

a. Both the Agilent N2264A and N2265A are multifunction modules, the specifications listed in this table are for the 16-bit digital I/O function on the Agilent N2264A and N2265A.

b. Both EI and CC lines are used for external controlled scanning. This item is for Agilent 44474A only.

c. When the next channel closes, the Agilent 44474A outputs a CC pulse to trigger the voltmeter. This item is for Agilent 44474A only.

Agilent 44472A VHF Switch Module

Agilent 44472A VHF Switch module contains 14 latching relays, which provides dual independent 4-to-1 coaxial MUXs. The specifications are listed in the table below.

ITEMS		SPECIFICATIONS
INPUT CHARACTERISTICS		
Total Channels:		dual 4
Connector Type:		BNC (x10)
Maximum Voltage	Center-Center or Center-Low: Low-Chassis or Low-Low:	250 V dc, 30 V ac rms or 42 V ac peak 42 V dc
Maximum Current	Per Channel:	30 mA dc, 300 mA ac rms
Thermal Offset	Per Channel:	< 15 µV
Characteristic Impedance:		50 Ω
Initial Closed Channel Resistance:		< 1 Ω
Relay Life	Dry Load of < 300 mA & < 10 V: Maximum Rated Load:	10^8 10^5
Maximum Scan Rate[a]**:**		43 Chans/sec
DC ISOLATION		
Between Any Two Points	< (40°C, 95% RH):	> 10^7 Ω
AC ISOLATION / PERFORMANCE[b]		
Capacitance	Center-Center, Center-Common: Center-Low: Low-Chassis:	< 0.002 pF < 70 pF < 0.20 µF
Rise Time:		< 0.7 ns
Signal Delay:		< 2.5 ns (channel match < 90 ps)
Insertion Loss (with 50Ω termination)	30 MHz: 100 MHz: 300 MHz:	< 0.50 dB < 0.75 dB < 1.25 dB
Crosstalk Within a Group (Channel-Channel or Channel-Common, with 50Ω termination)	30 MHz: 100 MHz: 300 MHz:	< -100 dB < -85 dB < -65 dB
Crosstalk Group to Group (with 50Ω termination)	30 MHz: 100 MHz: 300 MHz:	< -85 dB < -85 dB < -50 dB
VSWR (with 50 Ω termination)	30 MHz: 100 MHz: 300 MHz:	< 1.06 < 1.12 < 1.43

a. Using Agilent 44474A external increment & channel closed, display off.

b. When all channels in a group are opened, the last channel opened (or channel 00 or 13 following a group RESET) has channel-common isolation of > 80 dB @ 30 MHz, > 60 dB @ 100 MHz, and > 40 dB @ 300 MHz.

Agilent 44475A Breadboard Module

Agilent 44475A is a breadboard module, and the specifications are listed in the table below.

ITEMS	SPECIFICATIONS
MODULE DIMENTIONS	
Component Area Available:	104mm x 74mm and 79mm x 74mm (4.1" x 2.9" and 3.1" x 2.9")
Grid Hole Spacing (center-center):	2.54mm x 2.54 mm (0.1" x 0.1")
Grid Hole Size (inside diameter):	1.17mm (0.046")
Maximum Component Height (above board):	12.7mm (0.5")
Maximum lead Length (below board):	3.2mm (0.125")
INPUT CHARACTERISTICS	
Maximum Voltage:	42 V dc, 30 V ac rms, 42 V ac peak (on Breadboard area) 5.5 V (on Digital Input port lines)
Maximum Power Dissipation (per module):	2 Watt

Agilent 44476A Microwave Switch Module

Agilent 44476A is a microwave switch module, the specifications of it are listed in the table below:

ITEMS		SPECIFICATIONS
INPUT CHARACTERISTICS		
Frequency Range:		DC to 18 GHz
Characteristic Impedance:		50 Ω
Input Power Rating:		1 Watt average, 100 Watts peak (Also less than ±7 V dc)
Average Switch Life:		10^6 operations per channel
Repeatability (typical):		0.03 dB after 10^6 switchings
Maximum Scan Rate[a]**:**		43 Chans/sec
Connector:		SMA
AC ISOLATION / PERFORMANCE		
Isolation	DC - 18 GHz:	> 90 dB
Insertion Loss	DC - 2 GHz: DC - 18 GHz:	< 0.25 dB < 0.50 dB
VSWR (3 mm SMA)	DC - 2 GHz: DC - 12.4 GHz: DC - 18.0 GHz:	< 1.15 < 1.25 < 1.40

a. Using Agilent 44474A External Increment & Channel Closed, display off.

Agilent 44477A Form-C Relay Module

Agilent 44477A module provides seven independent, break-before-make, SPDT Form-C latching relays, the specifications of it are listed in the table below.

ITEMS		SPECIFICATIONS
INPUT CHARACTERISTICS		
Total Channels:		7
Maximum Voltage	Terminal-Terminal or Terminal-Chassis:	250 V dc or ac rms, 350 V ac peak
Maximum Current	Per Channel: Per Module:	2 A, dc or ac rms 14 A, dc or ac rms
Maximum Power	Per Channel: Per Module:	60 W dc; 500 VA ac 420 W dc; 3500 VA ac
Maximum Overvoltage Transients:		1400 V_{pk}
Thermal Offset:		< 3 µV per channel
Initial Closed Channel Resistance:		< 1 Ω
Relay Life	Dry Load of < 300 mA & < 10 V: Maximum Rated Load:	10^8 operations/chan 10^5 operations/chan
Maximum Scan Rate[a]**:**		43 Chans/sec
DC ISOLATION		
Open Channel, Channel-Channel (with 1 channel closed)	≤ (40°C, 60% RH): ≤ (40°C, 95% RH):	> 10^{11} Ω > 10^9 Ω
Channel-Chassis (with 1 channel closed)	≤ (40°C, 60% RH): ≤ (40°C, 95% RH):	> 5 x 10^{11} Ω > 10^{10} Ω
AC ISOLATION/PERFORMANCE[b]		
Capacitance (with 1 channel closed)	Open Channel, Channel-Channel: Channel-Chassis:	< 10 pF < 25 pF
Insertion Loss (with 50Ω termination)	100 kHz: 1 MHz: 10 MHz:	< 0.20 dB < 0.25 dB < 0.50 dB
Crosstalk (with 50Ω termination)	100 kHz: 1 MHz: 10 MHz:	< -73 dB < -53 dB < -33 dB

a. Using Agilent 44474A external increment & channel closed, display off.
b. With chassis of all instruments connected, and with the Low of input lines connected to the Low of output lines (either directly or via Agilent 3499A/B switched channels)

Agilent 44478A/B 1.3GHz MUX Modules

The specifications of the Agilent 44478A/B are listed in the table below. Specifications in the table describe the modules' warranted performance over the temperature range 0 to 55°C. Information marked by the *"Typical"* designation is helpful in applying the modules, but is non-warranted information.

ITEMS		SPECIFICATIONS
INPUT CHARACTERISTICS		
Total Channels:		dual 4
Maximum Voltage (any center/shield to any other center/shield/chassis):		42 V dc + ac peak
Maximum Current (per channel or common):		1 A dc, or ac rms
Maximum Power	Per Channel or Common: Each Resistive Termination:	24 W, 24 VA or 44 dBm 0.25 W, 0.25 VA or 24 dBm
Characteristic Impedance	Agilent 44478A: Agilent 44478B:	50 Ω 75 Ω
Relay Life (*Typical*)	With no load: At maximum rated power:	5×10^6 operations 10^5 operations
Maximum Scan Rate[a]**:**		43 Chans/sec
DC PERFORMANCE		
Thermal Offset (per channel):		< 6 µV (< 2 µV, *Typical*)
Initial Closed Channel Resistance:		< 1 Ω
Insulation Resistance (any terminal to any terminal)	≤ (40°C, 95% RH): ≤ (25°C, 40% RH):	$> 10^8$ Ω $> 10^{10}$ Ω (*Typical*)
AC ISOLATION / PERFORMANCE ($Z_L = Z_S$ = 50Ω or 75Ω)[b]		
Insertion Loss		
≤ 40°C, 95% RH	≤ 10 MHz: ≤ 100 MHz: ≤ 500 MHz: ≤ 1.3 GHz:	< 0.3 dB < 0.7 dB < 1.5 dB < 3.0 dB
≤ 25°C, 40% RH (*Typical*)	≤ 10 MHz: ≤ 100 MHz: ≤ 500 MHz: ≤ 1.3 GHz:	< 0.2 dB < 0.5 dB < 1.1 dB < 1.9 dB
Crosstalk[c]		
Channel-Channel, Channel-Common (with 1 channel closed)	≤ 10 MHz: ≤ 100 MHz: ≤ 500 MHz: ≤ 1.3 GHz:	< -90 dB < -80 dB < -65 dB < -55 dB
Group-Group, Module-Module	≤ 10 MHz: ≤ 100 MHz: ≤ 500 MHz: ≤ 1.3 GHz:	< -90 dB < -80 dB < -70 dB < -60 dB
VSWR	≤ 10 MHz: ≤ 100 MHz: ≤ 500 MHz: ≤ 1.3 GHz:	< 1.20 < 1.25 < 1.35 < 1.55
Capacitance	Center-Center: Center-Shield:	< 0.006 pF < 60 pF
Rise Time:		< 300 ps
Signal Delay:		< 3 ns (channel matched to ± 50 ps)

a. Using Agilent 44474A external increment & channel closed, display off.
b. $Z_L = Z_S$ = 50 Ω applies for Agilent 44478A and $Z_L = Z_S$ = 75 Ω applies for Agilent 44478B.
c. The CrossTalk specifications assume 50 Ω termination for 44478A and 75 Ω termination for 44478B. If all channels unterminated, derate specification by 6 dB.

Chapter 2
Getting Started

About This Chapter

This chapter describes the procedure to install the plug-in modules into a mainframe and mount the mainframe onto a system rack, followed by the basic front panel operations of an Agilent 3499A/B Switch/Control System. The chapter contents include:

- To Prepare the Instrument for Use ..... Page 13
- Module Installation ..... Page 14
- Operating the Instrument ..... Page 16
- To Rack Mount the Agilent 3499A/B ..... Page 19

To Prepare the Instrument for Use

Check the List of Supplied Items

Verify that you have received the following items with each one of your 3499A/B mainframe. If anything is missing, contact your nearest Hewlett-Packard Sales Office.

-- One power cord;
-- One *User's Guide* (default);
-- One *Quick Reference* (default)[1];
-- One Tie Down Clip 03499-21002 (for Agilent 3499B only);
-- Any plug-in modules you ordered, which were delivered in separate shipping containers.

This *Service Manual* must be ordered separately.

Initial Inspection

The Agilent 3499A/B was carefully inspected, both mechanically and electrically, before shipment. It should be free of any scratches and in perfect electrical order upon receipt. You should inspect the Unit for any damage that may have occurred in transit.

WARNING **To avoid potentially hazardous electrical shock, do not perform electrical tests when there are signs of damage to any portion of the outer enclosure.**

If the shipping container or packing material shows any signs of damage or stress, you should notify both carrier and the nearest Hewlett-Packard Sales Office.

[1]. The *Agilent 3499A/B Switch/Control System User's Manual* and the *Quick Reference* can be deleted when you ordered.

Power on the Instrument

Make sure no mechanical damages on the instrument, then you can perform the following procedure to verify that the instrument is in proper working order.

1. Connect the instrument to an AC power source with the supplied power cord.
2. Push the **Power** switch to power on the instrument.
3. On power-up, every segment in the display should light up briefly. The internal self-test will begin following this "starburst" display.
4. If the self-test passes, the default system mode and the GPIB address are displayed, together with a "beep" sound. Then the display shows the instrument model number.

Note If the instrument failed the self-test, contact your nearest Hewlett-Packard Sales Office.

If the Instrument Does Not Turn On

1. Verify that the power cord is firmly plugged into the power receptacle on the rear panel of the instrument.
2. Make sure that the power source the instrument is plugged into is energized.
3. Verify that the instrument is turned on.

Note If the instrument DOES NOT turn on after you perform the above procedure, contact your nearest Hewlett-Packard Sales Office.

Module Installation

WARNING **Only qualified personnel should install or remove the plug-in modules into or from an Agilent 3499A/B mainframe. Make sure to disconnect the power cord from the back of the mainframe prior to installing or removing any modules.**

Caution **Use anti-static procedures when configuring, installing or removing any plug-in modules. To prevent contamination to the modules that could degrade performance, handle the modules by the side edges or shields only. Do not touch the board surfaces or components.**

Module Installation

Upon receipt of an Agilent 3499A/B mainframe, the plug-in modules you ordered were not installed in the mainframe. In addition, the terminal block(s) and/or the cables ordered for wiring external test circuits are also separated from your modules.

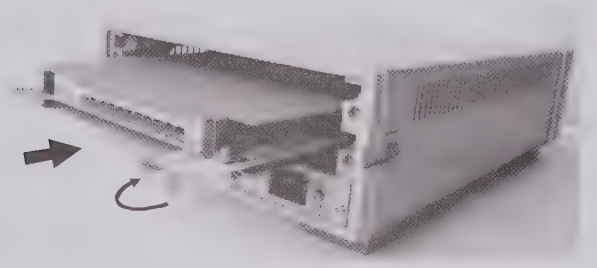
Figure 2-1 on Page 15 shows the procedure to install a plug-in module into

the mainframe 3499B, as well as to attach a screw terminal block onto the module. For 3499A, the installation procedure is the same as in 3499B. For the details about screw terminal blocks, crimp-and-insert terminal blocks and/or DIN-to-D cables wiring, see "Plug-in Modules Wiring Information" on Page 81.

STEP 1

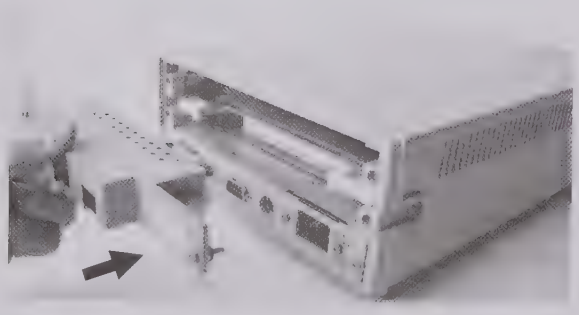
1. Face the mainframe rear panel towards you;
2. Select a slot in which the module is to be installed.

STEP 2



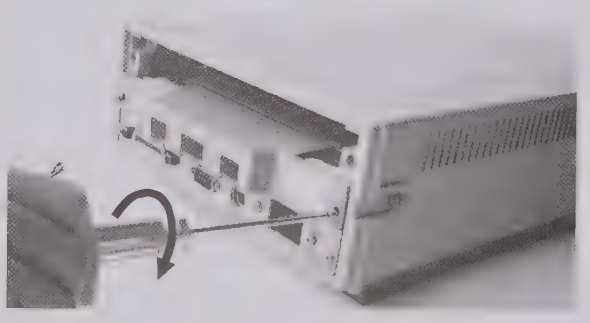
1. Hold the sides of the module, component side down, by the metal shields;
2. insert the module into the slot guides and slide the module towards the front of the instrument;
3. Push firmly until the module "snaps" into place;
4. Push both plastic levers inward to lock the module.

STEP 3 (Optional)



1. Wire the screw terminal block (module dependent, refer to Chapter 8 for details);
2. Attach the screw terminal block onto the plug-in module.

STEP 4 (Optional)



1. Push firmly until the terminal block "snaps" into place;
2. Lock the screw terminal block with the two screws (Torque < 8 in-lbs).

Figure 2-1. Module installation

Module Removal

To remove a plug-in module from an Agilent 3499A/B mainframe, reverse the procedures above.

Operating the Instrument

An Agilent 3499A/B Switch/Control System can be easily operated from the front-panel, or programmed with SCPI (in SCPI mode) or Agilent 3488A (in HP 3488A mode) commands over the remote interface.

The following sections are only intended to show some basic front-panel operation. For more information about the front panel operation, refer to Chapter 3 "Front-Panel Operation" starting from Page 21.

Channel Addressing

In Agilent 3499A/B Switch/Control System, a channel refers to an individual relay on a switching module, or an individual bit/port on a digital I/O module. The channel address is in the form of *snn*, where *s* represents slot number. Slot 0 refers to the mainframe controller board, s = 1-2 (for an Agilent 3499B) or s = 1-5 (for an Agilent 3499A); *nn* represents channel number (module dependent, see Table 2-1).

Table 2-1. Plug-in Modules Channel Addressing

Agilent P/N Descriptions	Channel Addressing (*snn*, *s* = Slot Number[a]; *nn* = Channel Number)	
	SCPI Mode	**HP 3488A Mode**
Agilent 44470A 10-Channel MUX Module	*s00, s01, s02, s03... s08, s09*	*Same as in SCPI mode.*
Agilent 44470D 20-Channel MUX Module	*s00, s01, s02, s03... s18, s19*	*Same as in SCPI mode.*
Agilent 44471A 10-Channel GP Relay Module	*s00, s01, s02, s03... s08, s09*	*Same as in SCPI mode.*
Agilent 44471D 20-Channel GP Relay Module	*s00, s01, s02, s03... s18, s19*	*Same as in SCPI mode.*
Agilent 44472A Dual 4-Channel VHF Module	Group 0: *s00, s01, s02, s03*; Group 1: *s10, s11, s12, s13*	*Same as in SCPI mode.*
Agilent 44473A 4 x 4 Matrix Module	Row: 0, 1, 2, 3; Column: 0, 1, 2, 3 (*s00, s01, s02, s03; s10, s11, s12, s13;* *s20, s21, s22, s23; s30, s31, s32, s33)*[b]	*Same as in SCPI mode.*
Agilent 44474A 16-Bit Digital I/O Module	Individual Bits: *s00, s01, s02... s14, s15* 8-Bit Ports: *s00, s01* 16-Bit Port: *s00*	Individual Bits: *s00, s01, s02... s14, s15* 8-Bit Ports: *s00, s01* 16-Bit Port: *s02*
Agilent 44475A Breadboard Module	N/A	N/A
Agilent 44476A 3-Channel 13 GHz Microwave Switch Module	*s00, s01, s02*	*Same as in SCPI mode.*
Agilent 44476B 2-Channel 26 GHz Microwave Switch Module	*s00, s01*	*Same as in SCPI mode.*
Agilent 44477A 7-Channel Form-C Relay Module	*s00, s01, s02, s03, s04, s05, s06*	*Same as in SCPI mode.*

Table 2-1. Plug-in Modules Channel Addressing

Agilent P/N Descriptions	**Channel Addressing** *(snn, s* = Slot Number[a]; *nn* = Channel Number)	
	SCPI Mode	**HP 3488A Mode**
Agilent 44478A/B 50/75 Ω 1.3 GHz MUX Module	Group 0: *s00, s01, s02, s03* Group 1: *s10, s11, s12, s13*	*Same as in SCPI mode.*
Agilent N2260A 40-Channel MUX Module[c]	1-Wire Mode: *s00, s01... s78, s79*[d] 2-Wire Mode: *s00, s01...s38, s39* Dual 2-Wire Mode: *s00, s01...s38, s39* 4-Wire Mode: *s00, s01...s18, s19*[e]	*s00, s01...s38, s39*[f]
Agilent N2261A 40-Channel GP Relay Module	*s00, s01, s02, s03... s37, s38, s39*	*Same as in SCPI mode.*
Agilent N2262A 4X8 Matrix Module	Row 0, 1, 2, 3; Column 0, 1, 2, 3... 6, 7 *(s00, s01, s02... s07; s10, s11, s12... s17; s20, s21, s22... s27; s30, s31, s32... s37)*	*Same as in SCPI mode.*
Agilent N2263A 32-Bit Digital I/O Module	Individual Bits: *s00, s01, s02... s30, s31;* 8-Bit Ports: *s00, s01, s02, s03;* 16-Bit Ports: *s00, s02;* 32-Bit Port: *s00.*	Individual Bits: *s00, s01, s02... s30, s31;* 8-Bit Ports: *s00, s01, s02, s03;* 16-Bit Ports: *s04, s05;* 32-Bit Port: *s06.*
Agilent N2264A 12-Channel GP Relay + 3-Channel High-current GP Relay + 16-Bit Digital I/O Module	12 GP Relays: *s00, s01, s02... s10, s11;* 3 High-current GP Relays: *s20, s21, s22;* **16-Bit Digital I/O:** Individual Bits: *s30, s31, s32... s44, s45;* 8-Bit Ports: *s30, s31;* 16-Bit Port: *s30.*	12 GP Relays: *s00, s01, s02... s10, s11;* 3 High-current GP Relays: *s20, s21, s22;* **16-Bit Digital I/O:** Individual Bits: *s30, s31, s32... s44, s45;* 8-Bit Ports: *s30, s31;* 16-Bit Port: *s32.*
Agilent N2265A 4X4 Matrix + 16-Bit Digital I/O Module	4X4 Matrix: Row 0, 1, 2, 3; Column 0, 1, 2, 3 *(s00, s01, s02, s03; s10, s11, s12, s13; s20, s21, s22, s23; s30, s31, s32, s33)* **16-Bit Digital I/O:** Individual Bits: *s40, s41, s42... s54, s55;* 8-Bit Ports: *s40, s41;* 16-Bit Port: *s40.*	4X4 Matrix: *Same as in SCPI mode.* **16-Bit Digital I/O:** Individual Bits: *s40, s41, s42... s54, s55;* 8-Bit Ports: *s40, s41;* 16-Bit Port: *s42.*
4-Bit Built-in Digital I/O	Individual Bits: *091, 092, 093, 094;* 4-Bit Port: *090.*	*Same as in SCPI mode.*

a. For an Agilent 3499A, the Slot Number = 1-5; for an Agilent 3499B, the Slot Number = 1-2.
b. A channel number on a matrix module is formed in Slot-Row-Column format, i.e., channel address s23 means row 2, column 3 in Slot s.
c. Agilent N2260A can be used as an 80-channel 1-wire MUX module, a 40-channel 2-wire MUX module, two 20-channel 2-wire MUX modules, or a 20-channel 4-wire MUX module in SCPI mode.
d. The Low (L) terminals of the 40 2-wire channels form the first 40 1-wire channels (Channels 00-39), and the High (H) terminals of the 40 2-wire channels form the second 40 1-wire channels (Channels 40-79).
e. The first channels (CH00 & CH20) of either banks (BANK 0 and BANK 1) form Channel 00, the second channels (CH01 & CH21) of either banks form Channel 01, and so on.
f. In HP 3488A mode, Agilent N2260A is used as a 40-channel 2-wire MUX module.

Basic Front-Panel Operation

The following examples demonstrate some basic operation to operated the Agilent 3499A/B. Assuming that an Agilent N2260A module is installed in slot 1 of the Agilent 3499A and configured as a 40-channel 2-wire MUX (default setting), the channels on the Agilent N2260A can be addressed as 100 through 139.

To Open/Close a Channel

Turn the knob to the desired channel (i.e. 102), the channel specified is shown on the channel display area.

MUX	OPEN	102

Press **Open/Close**[1] to open/close the selected channel.

Only one channel can be opened/closed each time, repeat the procedure above to open/close other channels.

Note To open all channels on a module, press **Card Reset**. To open all channels on the plug-in modules in an Agilent 3499A/B, press **Shift + Card Reset**[2], or cycle power the instrument.

To Change the Instrument System Mode

The Agilent 3499A/B can be operated in either one of the two system modes: SCPI mode and HP 3488A mode. The instrument is set to SCPI mode (factory default).

To change the system mode, press **Menu** first, turn the knob until the "SYSTEM MODE" is displayed, press **Enter**; then turn the knob to the specific system mode, press **Enter** again to change the instrument system mode.

Note Switching between SCPI mode and HP 3488A mode will reset the instrument to the factory default settings (except the GPIB address).

To View Relay Cycles

The relay cycle counts for the switching relays on Agilent N226X series modules can be read out. These modules include:

1. Agilent N2260A 40-Channel 2-Wire MUX Module;
2. Agilent N2261A 40-Channel GP Relay Module;
3. Agilent N2262A 4 x 8 2-Wire Matrix Switch Module;
4. Agilent N2264A Multifunction Module;

[1]. Press **Close** means to press the key **Close** on the front panel of the Agilent 3499A/B.
[2]. Press **Shift + Card Reset** means to press the key **Shift** first, then press the key **Card Reset**.

5. Agilent N2265A Multifunction Module.

To read out the relay cycles, press **View**, turn the knob until the "RELAY CYCLES" is displayed, press **Enter** to view the relay cycles of the switching relays. Turn the knob to view all the relay cycles on the plug-in modules.

Note "N/A" will be displayed a little while if there are no Agilent N226X series switching modules plugged into the instrument.

To View the Errors

The Agilent 3499A/B can store up to 10 errors in the error queue. Once an error occurs, the ERROR annunciator turns on.

To view the errors, press **View**, turn the knob until "ERROR" is displayed, press **Enter** to view the error. Refer to Appendix C "Schematics" starting from Page 97 for more error message.

Note In SCPI mode, the instrument will display "NO ERROR" for a little while, then return to the upper menu if the error queue is empty. In HP 3488A mode, the instrument will display "0000" if no error occurs.

To Rack Mount the Agilent 3499A/B

You can mount the Agilent 3499A/B mainframes on a standard 19-inch rack cabinet with the optional rack-mounting kits. The instructions and mounting hardware are included with each rack-mounting kit.

To Mount an Agilent 3499A

To rack mount an Agilent 3499A, the full-rack-width mainframe, order an adapter kit 5183-7171 (Figure 2-2).

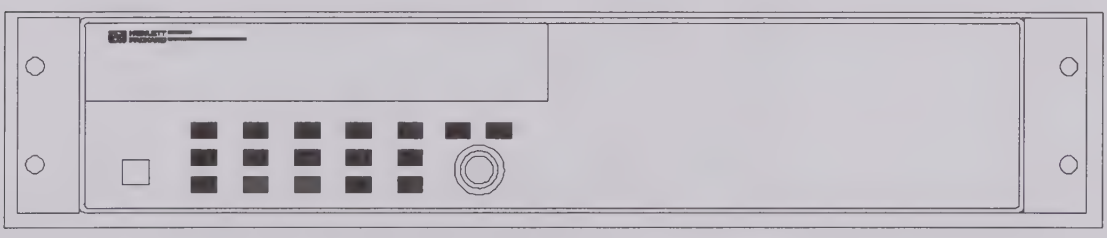


Figure 2-2. Rack Mount an Agilent 3499A

To Mount an Agilent 3499B

To rack mount a single Agilent 3499B, the half-rack-width mainframe, order an adapter kit 5183-7172 (Figure 2-3), or an Agilent Support Shelf

5063-9255, a slide kit 1494-0015 and a filler panel 5002-3999 (Figure 2-4).

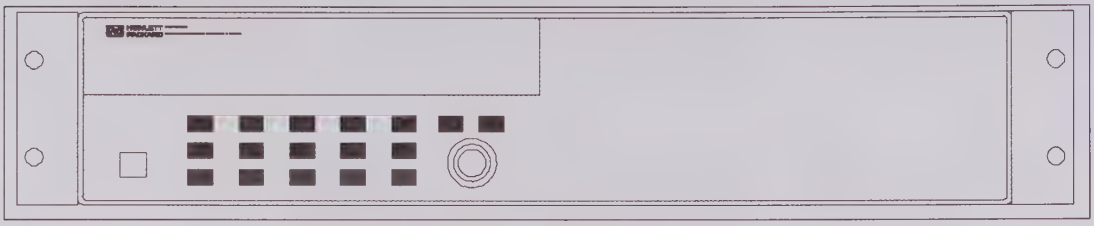


Figure 2-3. Rack Mount a Single Agilent 3499B - I

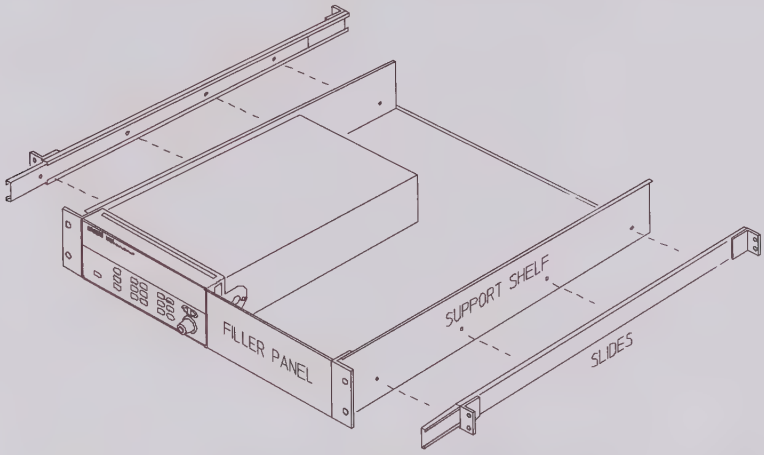


Figure 2-4. Rack Mount a Single Agilent 3499B - II

To rack mount two Agilent 3499B's side-by-side or any Agilent System II instrument side-by-side with an Agilent 3499B, order an Agilent Support Shelf 5063-9255, and a slide kit 1494-0015 (Figure 2-5).

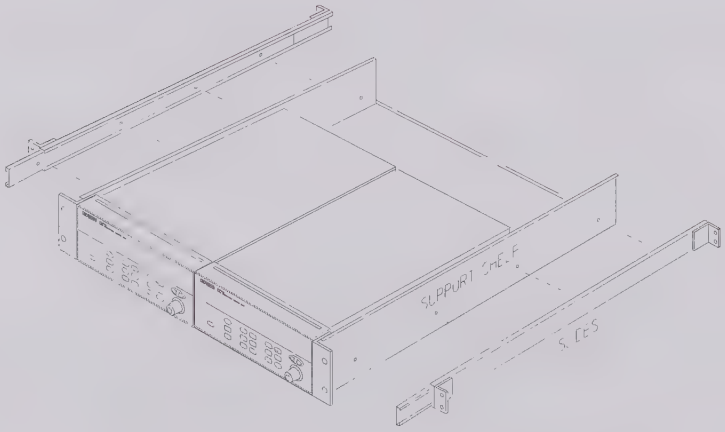


Figure 2-5. Rack Mount Two Agilent 3499B's Side-by-side

Note To rack mount an Agilent 3499B with an Agilent Support Shelf 5063-9255, a Tie Down Clip (P/N 03499-21002) provided with an Agilent 3499B must be used to fix the Agilent 3499B onto the shelf.

Chapter 3
Front-Panel Operation

About This Chapter

This chapter introduces you to each front-panel menu, it covers all aspects of front-panel operation. Chapter contents include:

- Front-Panel Overview . . . . . Page 22
- Local/Remote Control . . . . . Page 24
- To Monitor a Channel or a Slot . . . . . Page 24
- To Close or Open a Channel . . . . . Page 26
- To Read from a Digital I/O Port . . . . . Page 26
- To Write to a Digital I/O Port . . . . . Page 26
- To Store an Instrument State . . . . . Page 27
- To Recall an Instrument State . . . . . Page 28
- View Key Operation . . . . . Page 28
- Mode Key Operation . . . . . Page 30
- Scanning Operation . . . . . Page 33
- Menu Key Operation . . . . . Page 37
- To Reset a Module . . . . . Page 44
- To Reset the Instrument . . . . . Page 44

The following conventions are used for the front-panel operation.

- The keys on the front-panel keyboard are expressed in bold font and normally associated with a "press". For example, press **Mon**.
- The front panel display annunciators are expressed in bold font followed by an "annunciator". For example, **MON** annunciator.
- The information shown on the front panel display is enclosed within a pair of quotation marks.
- **Shift + Recall**[1] indicates the sequential operation: first press **Shift**, then press **Recall**.

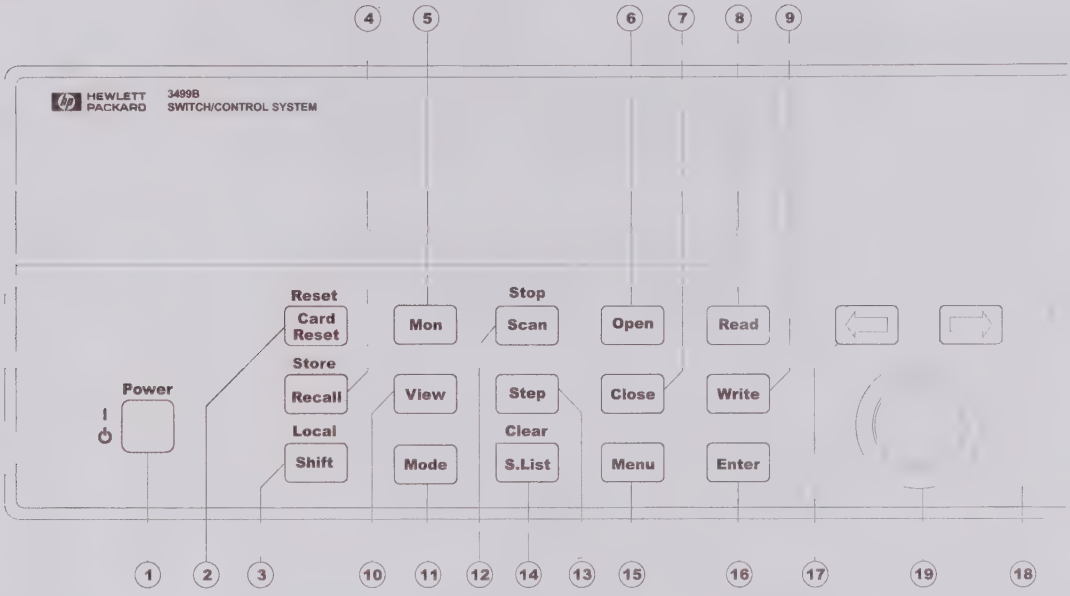
Note If no key is pressed within 5 seconds or an invalid key is pressed after the key **Shift** has been pressed, the **SHIFT** annunciator will turn off.

Note During a menu operation, if no key is pressed within 30 seconds or an invalid key is pressed, the instrument will exit the operation.

[1]. Also applicable to keys **Card Reset**, **Scan**, and **S.List**.

Front-Panel Overview

The Agilent 3499A/B can be operated in either SCPI mode or HP 3488A mode. All the operations demonstrated in this chapter apply to both modes, unless specifically indicated.



Note: 1. The keys labled with (10), (11), (14), and (15) guide you through menus to configure various parameters of the instrument. The details on these menus operation are demonstrated later in this chapter..

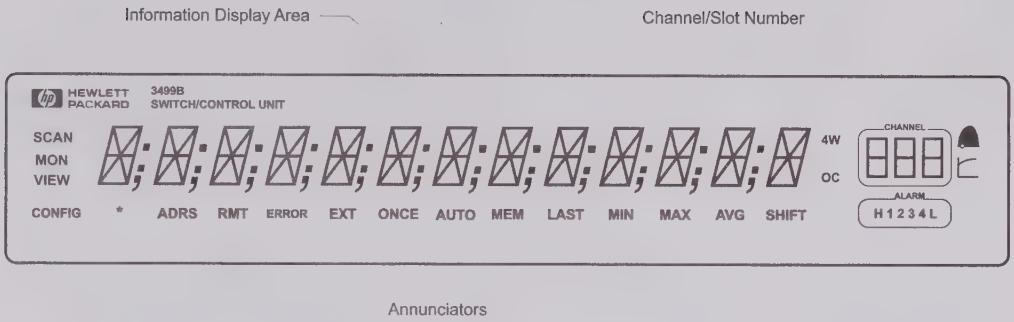
2. The keys labled with (2), (3), (4), (12) and (14) are double-function keys. See the next page for the rules of their operation.

---

1. Power on/standby
2. **a.** Reset a module
   b. Reset instrument
3. Shift/Local key
4. **a.** Recall instrument state
   b. Store instrument state
5. Monitor a channel/port/module
6. Open relay channel
7. Close relay channel
8. Read from DIO port
9. Write to DIO port
10. Enable View menu to:
    View errors
    View scan list
    View relay cycle counts
11. Enable Mode menu to:
    Configure MUX module
    Configure DIO module
12. **a.** Initiate scan
    b. Stop scan
13. Step through scan list
14. **a.** Enable S.List menu to:
    Create scan list
    Select arm source
    Select arm count
    Select trigger source
    Set channel delay time
    b. Clear scan list
15. Enable Menu menu to:
    Pair two modules together
    Enable/disable trigger out pulse
    Set instrument power-on state
    Configure GPIB/RS-232 interface
    Perform self-test
    Select SCPI/3488A mode
    Query firmware revision
    Query serial number
16. Confirm the selection
17. Left arrow key
18. Right arrow key
19. Knob

Figure 3-1. Agilent 3499B Front Panel

Display



As shown in above figure, the display is divided into three areas. Channel area displays the channel/port/slot number. The main display area displays the channel status (open/closed), or other information messages. Around the main display area are the annunciators, as listed in Table 3-1.

Table 3-1. Annunciators Summary

Annunciator	Indication
SCAN	Scan is initiated.
MON	Instrument is in monitor mode.
VIEW	Scan list, errors or relay cycle counts are being viewed.
CONFIG	Any configuration key has been pressed.
*	Instrument is advancing a scan step.
ADRS	Instrument is addressed to listen or talk over the remote interface.
RMT	Instrument is in remote mode.
ERROR	Error queue is not empty.
EXT	Scan is waiting for external trigger source.
SHIFT	Shift key has been pressed.

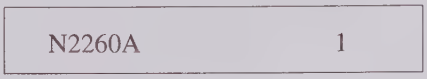
Channel Addressing

Many of the front-panel operations require you specify one or more channels. A channel refers to an individual relay on a switching module, or an individual bit/port on a digital I/O module. The channel address is in the form of *snn*, where *s* is the Slot Number (1-5 for an Agilent 3499A, 1-2 for an Agilent 3499B and Slot 0 reserves for the 4-bit built-in digital I/O), and *nn* represents channel number on the plug-in modules (module dependent). Refer to Table 2-1 on Page 16 for more details about the channel addressing.

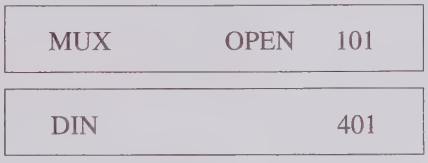
Channel/Slot Selection

The two arrow keys (<= and =>) together with the knob are used to select slots and channels. The following procedure shows you how to do that.

1. **Select a slot.** Press the two arrow keys to select a desired slot directly, or turn the knob to select the desired slot number.



2. **Select a channel**. Turn the knob to select a channel (3 digital number). As shown below, the top display indicates the current channel 101 is a MUX channel and in OPEN state, and the lower indicates that the current bit 401 is a digital input port.



Note **Open**, **Close**, **Read** and **Write** keys are invalid if a slot, instead of a channel, is selected.

To demonstrate the following operations more easily and clearly, we assume five modules have been installed in an Agilent 3499A mainframe. The configuration is:

Slot 1	Agilent N2260A MUX module
Slot 2	Agilent N2261A GP Relay module
Slot 3	Agilent N2262A Matrix module
Slot 4	Agilent N2263A Digital I/O module
Slot 5	Agilent N2260A MUX module

Local/Remote Control

When power-up, the instrument is in local mode. All keys on the front panel are fully functional. When receiving any command from the remote interface, the instrument automatically switches to remote mode (**ADRS** and **RMT** annunciators light up), all front-panel keys are locked, except the keys **Local, Mon, View, Enter,** the two arrow keys and the knob.

Local and **Shift** use the same key. While in local mode, it is used as **Shift** key. While in remote mode (the **RMT** annunciator turns on), it is used as **Local** key.

To Monitor a Channel or a Slot

In a switch/control system, it is necessary to acquire, confirm and continuously monitor the current status of a particular switching channel, a

digital I/O port, or an entire plug-in module. Agilent 3499A/B provides you the ability to achieve the above.

1. Press **Mon**, the **MON** annunciator lights up;
2. Select the slot or the channel/port to be monitored;
3. Press **Enter** to display the next part if necessary;
4. Press **Mon** again to exit the monitoring state, the **MON** annunciator turns off.

Table 3-2. Display on Monitoring Mode

Display	Description
1:0, , , , , ,6; , ,9, 2	The display for a multiplexer or a GP relay module. This display indicates that the monitored module is in Slot 2 and channels 10, 16, and 19 are closed.
ROW 3: ,1, ,3, , ,6,7 3 0; , ,3,COL 3, 3	The display for a matrix module. The top is the row information, indicating that the relays on Row 3, Columns 1, 3, 6 and 7 of the module (in Slot 3) are closed. The lower display is the column information, indicating that relays on column 3, row 0 and 3 are closed.
00:H255 L254. 4	The display for a digital I/O module. The first 2 digits on the left ("00" in this case) represents the "L" 8-bit port address. Adding one to this value, the "H" 8-bit port address is obtained. Data with a trailing decimal point indicates that the last operation on that port was a WRITE, data without a trailing decimal point indicates that the last operation on that port was a READ. This display shows that the data last read from Port 401 is 255 and the data last written to Port 400 is 254.
DIO 12 090 DOUT 0 091	The top display is for the built-in digital I/O Port *090* and the data from the last operation. The lower display indicates that data last written to the bit channel 091 is 0.
ROW 0: ,1, ,3, 5 00:H255 L254. 5	For a multifunction module, the first function on the module is displayed, then the next. This display is an example of a multifunction module with matrix and DIO functions.

Note The built-in digital I/O can be monitored either as individual bit channels (*091-094*) or as a 4-bit port (*090*).

Note For MUX modules and GP Relay modules, 10 channels can be displayed at one time; for matrix modules, one ROW or one Column can be displayed at one time; for digital I/O modules, two 8-bit ports can be displayed at one time. For multifunction modules, the first function on the module is displayed, then the next.

To Close or Open a Channel

To close/open a channel, you need to:

1. Select the channel to be closed or opened;
2. Press **Close/Open** to close/open the channel.

Repeat steps 1 & 2 to close or open other channels.

To Read from a Digital I/O Port

To read data from the built-in digital I/O port/bits (*090-094*), or any one of the 8-bit ports on a digital I/O, you need to:

1. Select a digital I/O port;
2. Press **Read** to read data from the selected port.

   For example, the display below shows the data read from Port 401.

DIN 255 401	Decimal format
DIN 11111111 401	Binary format

Note Data display format of individual 8-bit ports can be specified either in binary or decimal. Once specified, the format applies to all input and output operations on the same port (refer to "Mode Key Operation" on Page 30).

To Write to a Digital I/O Port

To write data to the built-in digital I/O port/bits (*090-094*), or any one of the 8-bit ports on a digital I/O, you need to:

1. Select a digital I/O port to be written to ("DIN" indicates that the last operation on the port is a READ, and "DOUT", a WRITE);

   DIN 401

2. Press **Write**, the data from the last operation (READ or WRITE) on the selected port will be displayed and "DOUT" is displayed to indicate the port is now an output port;

   DOUT 255 401

3. Edit the value. Press the two arrow keys to select the to-be-edited bit (in dim), turn the knob to modify the value;

DOUT 254 401

4. Press **Enter** to output the data to the selected port, or press **Write** again to cancel the current write operation.

To Store an Instrument State

The current instrument setup can be stored for future use. The stored setups can be recalled directly, or included in a scan list. However, the stored instrument setup in SCPI mode is different from that in HP 3488A mode. Table 3-3 lists these differences.

Table 3-3. The Differences Between Two Modes

SCPI Mode	HP 3488A Mode
Stored information: 1. Status of relay channels (open/close); 2. Status of digital I/O ports (input/output) on digital I/O modules in either static Mode #1 or Mode #2; 3. Module configurations: card pair, 1/2/4-wire function mode, baud rate, flow control, etc.; 4. Scanning setups: scan list, arm count, arm source, etc.	Stored information: 1. Status of relay channels (open/close); 2. Status of digital I/O ports (input/output) on digital I/O modules in either static mode1 or mode2.
Up to10 instrument states can be stored (numbered 1-10).	Up to 40 instrument states can be stored (numbered 1-40).

To store a instrument setup:

1. Press **Shift** + **Recall,** the display would be:

STORE 01

2. Turn the knob to change the memory location number (i.e. 05);

STORE 05

3. Press **Enter** to store the current instrument setup (to location 5).

Note An instrument power-on or reset does not affect the stored instrument setup information. Once a setup is stored, it remains until overwritten or specially deleted with a SCPI command SYSTem:STATe:DELete.

Note All the stored instrument setups will be cleared automatically whenever the system mode is changed.

To Recall an Instrument State

A previously stored instrument setup can be recalled. Before recalling a stored setup, the instrument verifies that all module type and slot assignment match the setup. If a mismatch is detected, the recall operation will stop and a string "RECALL FAILED" will be returned (no error occurs).

To recall an instrument setup:

1. Press **Recall,** turn the knob to a previously stored setup (i.e. 05);

RECALL 05

2. Press **Enter** to recall the setup (i.e. 05); press **Recall** again to cancel the current recall operation.

View Key Operation

The instrument can store up to 10 errors[1] in the error queue, up to 200 channels in the scan list, as well as the relay cycle counts on the newer plug-in modules. The **View** key provides you an intuitive way to query these information. Table 3-4 lists the **View** key structure.

Table 3-4. View Key Structure

1st level Items	Description
ERROR	Query the errors recorded in the error queue.
SCAN LIST	Query the channels included in the scan list.
RELAY CYCLES	Query the relay cycle counts on some modules.

To View an Error

To view an error:

1. Press **View** (the **VIEW** annunciator turns on), turn the knob to "ERROR", then press **Enter**;
2. If no error is in the error queue (the **ERROR** annunciator is off), the instrument displays "NO ERROR", and then returns to the first level of the View menu automatically.

NO ERROR 108

If there are errors (the **ERROR** annunciator is on), the first error in the error queue is displayed. Press the arrow key to scroll the display

[1]. In HP 3488A mode, only the sum of the values of the possible error conditions, as defined in Table 9-2 on Page 276, is recorded in the error queue and shown on the front panel.

to show the whole error message;

01:ERR -109

MISSING PARAMETER

3. Turn the knob to view other errors in the error queue, or press **Enter** to return to the first level of the View menu, the **ERROR** annunciator turns off;
4. Press **View** again to exit the View menu operation, the **VIEW** annunciator turns off.

Note All errors are cleared once the error queue is viewed, and the **ERROR** annunciator turns off. Refer to Appendix B starting from Page 91 for details about the instrument errors.

To View a Scan List

To view the channels included in a scan list (assuming channels 103-107 are included in the scan list):

1. Press **View** (**VIEW** annunciator lights up). Turn the knob until "SCAN LIST" is displayed, then press **Enter**;

SCAN LIST	101

2. The first channel in the scan list is displayed on the channel area. Continuously turn the knob to view other channels in the scan list;

001 OF 005	103

3. Press **Enter** to return to the first level of the View menu;

SCAN LIST	107

4. Press **View** again to end this operation, the **VIEW** annunciator turns off.

To View the Relay Cycles

To view the relay cycle counts:

1. Press **View**, the **VIEW** annunciator lights up. Turn the knob until "RELAY CYCLES" is displayed, then press **Enter**;

RELAY CYCLES	400

2. If no module with the relay cycle count feature[1] is present, "N/A" will be displayed, then the display automatically returns to the first

level of the View menu;

N/A	400

If the selected channel is a relay without the cycle counts feature, the instrument will display the cycle counts of the first relay with the feature;

7383	100

If the selected channel (i.e. 109) is a relay with the cycle counts feature, the cycle counts of the relay will be displayed;

10132	109

3. Turn the knob to read other relays cycle counts, or press **Enter** to return to the first level of the View menu;

RELAY CYCLES	108

4. Press **View** again to exit the View menu operation, the **VIEW** annunciator turns off.

Mode Key Operation

A digital I/O and the digital I/O ports can be configured from the instrument front panel. In SCPI mode, Agilent N2260A can be configured as different MUX modules. The Mode key is designed for these configurations.

- Agilent N2260A can be configured in SCPI mode. Table 3-5 shows the **Mode** key structure in this case.

Table 3-5. Agilent N2260A Configuration (Mode)

1st level Items	2nd Level Items	Description
CONFIG MUX	WIRE1 WIRE2 WIRE4 DUAL WIRE2	Configure Agilent N2260A Multiplexer module to work as: 80-channel 1-wire, 40-channel 2-wire, 20-channel 4-wire, or two independent groups of 20-channel 2-wire module.

- The digital I/O modules can be configured in either SCPI mode or HP 3488A mode. Table 3-6 on Page 31 shows the **Mode** key structure.

[1]. Relay cycle count feature is supported by the switching relays on the Agilent N2260A/61A/62A/64A/65A modules.

Note The 4-bit built-in digital I/O in Slot 0 cannot be configured.

- The **Mode** key shows a completely different structure (Table 3-7) when it is used to configure a digital I/O port.

Table 3-6. Digital I/O Configuration (Mode)

1st level Items	2nd Level Items	3rd Level Items	4th Level Items	5th Level Items	Description
CONFIG DIO	MODE 1 MODE 2 MODE 3 MODE 4 MODE 5	CONT POL POS CONT POL NEG	FLAG POL POS FLAG POL NEG	I/O POL POS I/O POL NEG	Configure DIO module, including the handshake mode, the control line and flag line polarities, and the polarity of the I/O direction line.

Table 3-7. Digital I/O Port Configuration (Mode)

1st Level Items	2nd Level Items	Description
DATA POLARITY	POS POLARITY NEG POLARITY	Set the polarity of the data lines for the port.
DISP FORMAT	DECIMAL BINARY	Set data display format for the port.

Agilent N2260A Configuration

To configure an Agilent N2260A MUX module:

1. Select a slot in which an Agilent N2260A module is installed;

N2260A	1

2. Press **Mode**, the **CONFIG** annunciator lights up and "CONFIG MUX" is displayed;

CONFIG MUX	1

3. Press **Enter**, turn the knob to select one mode (i.e. WIRE1);

WIRE1	1

4. Press **Enter** to return to "CONFIG MUX", press **Mode** again to exit the configuration, the **CONFIG** annunciator turns off accordingly.

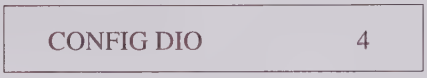
DIO Module Configuration

A digital I/O module can be configured, which include the flow control mode, the control line polarity, the flag line polarity, and the I/O direction line polarity.

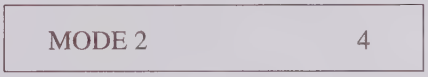
To configure a digital I/O module:

1. Select a slot in which a digital I/O is installed;

2. Press **Mode**, the **CONFIG** annunciator lights up and "CONFIG DIO" is displayed, then press **Enter**;



3. Turn the knob to select the flow control mode (i.e. MODE 2), then press **Enter**;



4. Turn the knob to select the control line polarity (i.e. CONT POL POS), then press **Enter**;

5. Turn the knob to select the flag line polarity (i.e. FLAG POL POS), then press **Enter**;

6. Turn the knob to select the I/O line polarity (i.e. I/O POL POS), then press **Enter**;

7. The instrument returns to "CONFIG DIO", press **Mode** again to exit the configuration, the **CONFIG** annunciator turns off accordingly.

DIO Port Configuration

To configure the data line polarity and data display format for an individual digital I/O port:

1. Select a digital I/O port (i.e. Port 401), press **Mode** (the **CONFIG** annunciator lights up). Turn the knob to select one item (i.e. DATA POLARITY);

2. Press **Enter**, turn the knob to select the polarity (i.e. NEG

POLARITY);

NEG POLARITY	401

3. If another item "DISP FORMAT" is selected, press **Enter**, then turn the knob to select the data display format (i.e. BINARY);

BINARY	401

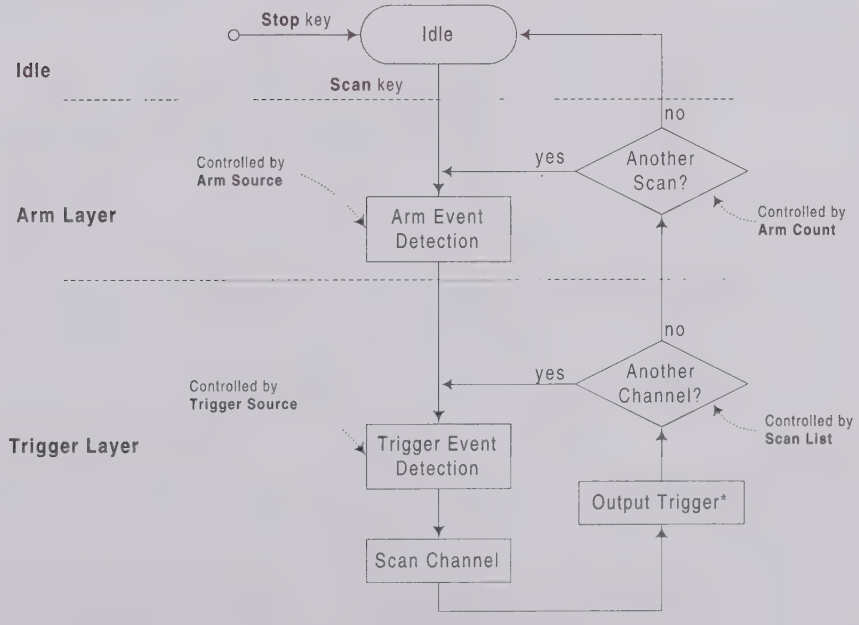
4. Press **Enter** to select the data display format and return to "DISP FORMAT", press **Mode** again to exit the configuration, the **CONFIG** annunciator turns off accordingly.

To configure other digital I/O ports, repeat Steps 1 through 4.

Note Once you have selected the data display format for a port, it applies to all input and output operations on that port.

Scanning Operation

The scan operation in SCPI mode is different from that in HP 3488A mode. In HP 3488A mode, you only need to create a scan list, then step through the scan list by repeatedly pressing **Step**. However, scanning in SCPI mode has more features (refer to Figure 3-2).



* Note: The trigger out pulse will occur at the specified trig-out line only if you have configured to enable the slot to output.

Figure 3-2. The Process of Scanning Operation (in SCPI mode)

Overview

Before initiating a scan, a scan list must be set up. You can also specify an arm source, a trigger source, and the number of sweeps (a sweep is one pass through the scan list) to control the scan process. All these can be done from the **S.List** key. The **S.List** key structure in SCPI mode (Table 3-8) is different from that in HP 3488A mode (Table 3-9 on Page 34).

Table 3-8. S.List Key Structure in SCPI Mode

1st Level Items	2nd Level Items	3rd Level Items	4th Level Items	Description
ADD TO SCAN	SELECT nnn			Create a scan list to include all the desired switch channels, DIO bit channels, and/or the previously stored setups.
CONFIG SCAN	ARM: TIMER ARM: IMM ARM: BUS ARM: EXT ARM: MIX ARM: HOLD	COUNT: 00001	TRIG: TIMER TRIG: IMM TRIG: BUS TRIG: EXT TRIG: MIX TRIG: HOLD	Configure the scan operation, such as an arm source, an arm count, and a trigger source.
DELAY TIME	SET ALL	nnnnn.nnn SECS		Set delay time for all channels or for individual channels.
	SET CH	SELECT nnn	nnnnn.nnn SECS	

Table 3-9. S.List Key Structure in HP 3488A Mode

1st Level Items	2nd Level Items	Description
ADD TO SCAN	SELECT nnn	Create a scan list to include all the desired switch channels, DIO bit channels, and/or the previously stored setups.
DELAY TIME	nnnnn.nnn SECS	Set a delay time for all scanned channels.

To Create a Scan List

To create a scan list, you can:

1. Press **S.List,** the **CONFIG** annunciator lights up, and "ADD TO SCAN" is displayed;

   ADD TO SCAN 101

2. Press **Enter**, then turn the knob to select a previously stored channel setup (i.e. 001). Press **Enter** to add it into the scan list;

   SELECT * 001

3. To add other switch channels, digital I/O bits, and/or other stored channel setups, repeat Step 2;

4. Press **S.List** again to return to "ADD TO SCAN", press **S.List** once more to exit this operation, the **CONFIG** annunciator turns off accordingly.

Note To view a scan list, press **View**. To clear a scan list, press **Shift + S.List**.

To Configure a Scan

The Arm Source, Arm Count and the Trigger Source can be set to configure a scan:

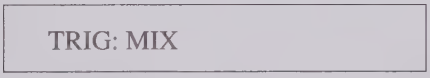
1. Press **S.List**, the **CONFIG** annunciator lights up. Turn the knob until "CONFIG SCAN" is displayed, then press **Enter**;

2. Turn the knob to set the arm source, then press **Enter**;

   If "ARM:TIMER" is specified, the instrument will guide you to set the time interval (default is 0) after pressing **Enter**. Use the two arrow keys and the knob to edit or modify the value. Press **Enter** to set this value (ranging from 0 to 99999.999 seconds);

3. Use the arrow keys and the knob to set the arm source, press **Enter**;

4. Turn the knob to set the trigger source, then press **Enter** to return to "CONFIG TO SCAN";



   If "TRIG:TIMER" is specified, the instrument will guide you to set the time interval (default is 0) after pressing **Enter**. Use the two arrow keys and the knob to edit or modify the value. Press **Enter** to set this value (ranging from 0 to 99999.999 seconds) and return to "CONFIG TO SCAN";

5. Press **S.List** again to exit this operation, the **CONFIG** annunciator turns off accordingly.

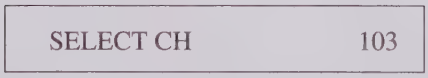
To Set a Delay Time

1. Press **S.List**, the **CONFIG** annunciator lights up. Turn the knob until

"DELAY TIME" is displayed, press **Enter**;

2. To set a uniform delay time for all channels, select "SET ALL", then press **Enter**. Use the arrow keys and the knob to modify the value (between 0 and 99999.999 seconds). Press **Enter** to set the delay time and return to "DELAY TIME";

3. To set a different delay time for individual channel, select "SET CH", then press **Enter**. Turn the knob to select the channel to be set (i.e. 103), then press **Enter** again and use the arrow keys and the knob to set its delay time (between 0 and 99999.999 seconds). Press **Enter** once more to set the delay time and return to "SET CH" item;



4. To set a delay time for other channel, repeat the procedure above. Press **S.List** again to return to "DELAY TIME";
5. Press **S.List** once more to exit this operation, the **CONFIG** annunciator turns off accordingly.

To Start a Scan

To start a scan[1]:

1. Press **Scan**, the **SCAN** annunciator lights up;
2. Then the instrument will continue scanning according to the configuration. The arm source is used to control the onset of each

scan sweep. The trigger source is used to advance one channel in the scan list (open the previous channel and close the next channel in the list, the * annunciator lights up);

3. When the scanning is finished, the instrument returns to the idle state and the **SCAN** annunciator turns off. To stop the scanning in progress press **Shift + Scan**.

Note Once a scan list exists, simply press **Step** repeatedly to step through the scan list. In this case, the **SCAN** and the * annunciators turn off.

Note Card Pair is functional during a scan, which means that both the channels included in the scan list and the paired channels will be scanned.

Menu Key Operation

Configuring system-related instrument parameters can be done from the **Menu** key. However, the **Menu** key structure in HP 3488A mode (Table 3-10) is different from that in SCPI mode (Table 3-11 on Page 38). Since SCPI mode can do whatever HP 3488A mode can, only the **Menu** key operation in SCPI mode will be demonstrated.

Table 3-10. Menu Key Structure in HP 3488A Mode

1st Level Items	2nd Level Items	3rd Level Items	4th Level Items	Description
CARD PAIR	FIRST SLOT 1	SECOND SLOT -		Pair the same (type) cards.
CONF EXT TRIG	TRIG OF SLOT 0	ENABLE DISABLE		Select a pair of external trigger lines and enable/disable the Agilent 3499 to output a trigger pulse.
INTERFACE	GPIB/488	ADDRESS 09	SRQ ON SRQ OFF	Set GPIB address (0-30) and enable/disable Power-on SRQ.
SELFTEST				Perform a selftest.
SYSTEM MODE	SCPI MODE			Select a system mode for the instrument.
	HP 3488A MODE			
REVISION INFO				Query the current firmware revision.
SERIAL NO				Query Agilent 3499A/B serial number.

[1]. The scan cannot be performed and "CANNOT INIT" will be displayed if any of the following conditions occurs:
a. The scan list contains a non-existing channel, such as N2260A module changes from WIRE1 to WIRE2.
b. The scan list contains a channel on a digital I/O module that does not work in Mode #1 or Mode #2.
c. A stored channel setup in the scan list does not match the current hardware configuration.

Table 3-11. Menu Key Structure in SCPI Mode

1st Level Items	2nd Level Items	3rd level Items	4th level Items	Description
CARD PAIR	FIRST SLOT 1	SECOND SLOT -		Select the cards to be paired together.
CONF EXT TRIG	TRIG SLOT 0	ENABLE DISABLE		Select a pair of external trigger lines and enable/disable Agilent 3499 to output a trigger pulse.
POWER ON SET	PWR ON RESET			Set instrument power-on to the reset state or a state stored in memory location nn.
	USER SET UP	POWER ON nn		
INTERFACE	GPIB/488	ADDRESS 09	SRQ ON SRQ OFF	Select GPIB interface, then set its address (0-30) and enable/disable Power-on SRQ.
	RS-232	2400 BAUD; 4800 BAUD; 9600 BAUD; 19200 BAUD; 38400 BAUD; 57600 BAUD		Select RS-232 interface and configure its baud rate, data bits, parity, and flow control mode. The defaults are 9600 BAUD, NONE, 8 BITS, and FLOW NONE.
		ODD, 7 BITS; EVEN, 7 BITS; NONE, 8 BITS		
		FLOW NONE; FLOW XON/XOFF; FLOW DTR/DSR; FLOW RTS/CTS		
SELFTEST				Perform a selftest.
SYSTEM MODE	SCPI MODE			Select a system mode for operation.
	HP 3488A MODE			
REVISION INFO				Query the current firmware revision.
SERIAL NO				Query Agilent 3499A/B serial number.

The following operations can be done with the **Menu** key in SCPI mode:

- To pair two cards;
- To configure the external trigger;
- To configure the power-on state;
- To configure the remote interface;
- To perform a self-test;
- To select a system mode;
- To query the firmware revision;
- To query the serial number.

Note In HP 3488A mode, the Agilent 3499A/B does not support configuring RS-232 interface and the instrument power-on state.

To Pair Two Cards

Two same type plug-in modules (cards) can be paired. Once paired, any operation on a channel of one module will be duplicated on the corresponding channel of the paired module. To pair two same type cards:

1. Press **Menu**, the **CONFIG** annunciator lights up. Turn the knob to select "CARD PAIR", press **Enter**;

CARD PAIR

2. When "FIRST SLOT 1" is displayed, turn the knob to select the first paired slot (i.e. Slot 1), then press **Enter**[1];

FIRST SLOT 1

3. When "SECOND SLOT -" is displayed, turn the knob to select the second slot (i.e. 5) to be paired with the first;

SECOND SLOT 5

4. Press **Enter** to return to "CARD PAIR", press **Menu** again to exit this operation, the **CONFIG** annunciator turns off accordingly.

To Configure the External Trigger

Agilent 3499A/B provides two pairs of trigger lines for externally-controlled scanning. The first pair (TRIG IN & TRIG OUT) is on the rear panel of the mainframes, the second pair of EI (External Increment) & CC (Channel Closed) is on the Agilent 44474A. You can use only one pair of the trigger lines each time, and specify whether a trigger out pulse can be sent out when a relay is closed during a scan.

To configure the external trigger:

1. Press **Menu**, the **CONFIG** annunciator lights up. Turn the knob to select "CONF EXT TRIG", then press **Enter**;

CONF EXT TRIG

2. Select either Slot 0 (Agilent 3499A/B) or the slot in which an Agilent 44474A is installed, then press **Enter**;

TRIG SLOT 0

3. To enable a trigger pulse output from the selected line, turn the knob to select "ENABLE"; or select "DISABLE";

ENABLE

4. Press **Enter**, the instrument returns to "CONF EXT TRIG". Press **Menu** again to exit this operation, the **CONFIG** annunciator turns off accordingly.

[1]. In case there are no matching cards installed in the mainframe, the display will show "NO MATCH", then automatically returns to the first level of the Menu menu.

Note In the SCPI mode, once a new pair of control lines is selected, the newly selected trigger-in line is immediately ready to accept the trigger signal from an external instrument. However, in HP 3488A mode, only after the newly selected pair is enabled, will the previously enabled pair be disabled. Otherwise, the previously enabled pair is still in effect.

To Configure the Power-on State

The power-on state of the Agilent 3499A/B can be set to the reset state, or to a stored state. The instrument will return to the specified state the next time it is turned on. To configure the power-on state:

1. Press **Menu**, the **CONFIG** annunciator lights up. Turn the knob to select "POWER ON SET", then press **Enter**;

   POWER ON SET

2. To set the instrument power-on to reset state, turn the knob to select "PWR ON RESET", then press **Enter**, the instrument will return to "POWER ON SET";

   PWR ON RESET

   To set the instrument power-on to a stored state, turn the knob to select "USER SET UP", then press **Enter**[1]. Turn the knob to specify a memory location (i.e. 05), press **Enter** again to return to "POWER ON SET";

   USER SET UP

   POWER ON 05

3. Press **Menu** again to exit this operation, the **CONFIG** annunciator turns off accordingly.

Note If the power-on state of the instrument is set to a previously stored setup that is no longer valid, the power-on state will automatically set to the reset state, in this case the instrument displays "RECALL FAILED".

[1]. "NO DATA" will be displayed if no state had ever been stored, then the instrument automatically returns to the first level of the Menu menu.

To Configure the Remote Interface

The instrument can communicate with a computer over GPIB or RS-232 interface. Perform the following procedure to configure the interface.

Note Only one interface can be used at a time. When shipped from the factory, the GPIB interface is selected and its address is set to "9".

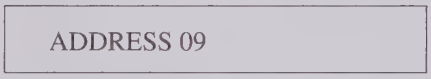
Note RS-232 interface can be configured and used only in SCPI mode.

GPIB Interface

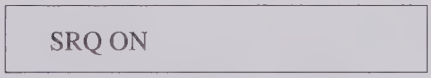
1. Press **Menu**, the **CONFIG** annunciator lights up. Turn the knob to select "INTERFACE", then press **Enter**;

2. Turn the knob to select "GPIB/488", then press **Enter**;

3. Turn the knob to set a valid GPIB address (0-30), then press **Enter**;



4. When "SRQ ON" is displayed, press **Enter**, the Agilent 3499A/B will interrupt the system computer when powered up. To disable this feature, select "SRQ OFF", then press **Enter**;



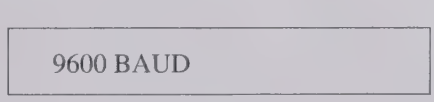
5. The instrument returns to "INTERFACE", press **Menu** again to exit this operation, the **CONFIG** annunciator turns off.

RS-232 Interface

1. Press **Menu**, the **CONFIG** annunciator lights up. Turn the knob to select "INTERFACE", then press **Enter**;

2. Turn the knob to select "RS-232", then press **Enter**;

3. Turn the knob to select the baud rate (default: 9600), then press **Enter**;



4. Turn the knob to select the parity and data bits (default: NONE, 8 BITS), then press **Enter**;

5. Turn the knob to select the mode (default: FLOW NONE), then press **Enter** to return to "INTERFACE";

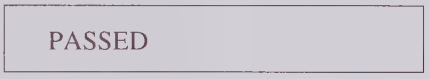
6. Press **Menu** again to exit this operation, the **CONFIG** annunciator turns off accordingly.

To Perform a Self-test

The self-test feature of the instrument can be used to verify proper instrument operation. To perform a self-test:

1. Press **Menu**, the **CONFIG** annunciator lights up. Turn the knob to select "SELFTEST", then press **Enter**;

2. If all the tests have passed, "PASSED" will be displayed. Otherwise, the reason of the failure will be displayed;



Note For more about the self-test errors, refer to Appendix B starting from Page 91.

3. Press **Enter** to return to "SELFTEST", press **Menu** again to exit this operation, the **CONFIG** annunciator turns off accordingly.

To Select a System Mode

The instrument can be operated in either SCPI mode or HP 3488A mode. To select a system mode:

1. Press **Menu**, the **CONFIG** annunciator lights up. Turn the knob to select "SYSTEM MODE", then press **Enter**;

2. Turn the knob to select the system mode, press **Enter**;

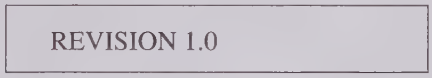
3. The instrument will be reset if the system mode has been switched; or it will display "SYSTEM MODE". In later case, press **Menu** again to exit this operation.

To Query the Firmware Revision

To query the Agilent 3499A/B firmware revision:

1. Press **Menu**, the **CONFIG** annunciator lights up. Turn the knob to select "REVISION INFO", then press **Enter**;

2. The system firmware revision number will be displayed;

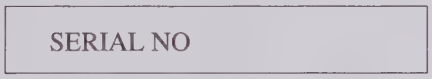


3. Press **Enter** to return to "REVISION INFO", press **Menu** again to exit this operation, the **CONFIG** annunciator turns off accordingly.

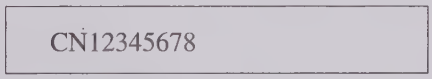
To Query the Serial Number

To query the Agilent 3499A/B serial number:

1. Press **Menu**, the **CONFIG** annunciator lights up. Turn the knob to select "SERIAL NO";



2. Press **Enter**, Agilent 3499A/B serial number is displayed;



3. Press **Enter** to return to "SERIAL NO", press **Menu** again to exit this operation, the **CONFIG** annunciator turns off accordingly.

To Reset a Module

To reset a plug-in module:

1. Turn the knob to select the slot to be reset;

2. Hold down **Card Reset** until the display changes from "HOLD TO RESET" to "RESET CARD", then release the key to end this operation.

Note **Card Reset** will open all channels on the switching module and make all ports on the specific digital I/O module as input ports.

To Reset the Instrument

To reset the instrument:

1. Press **Shift,** then hold down **Card Reset**, the display would be:

2. Hold the key until the display message changes, then release the key;

3. When the instrument finishes resetting, the default display appears.

Note The instrument will also be reset if any plug-in module is installed or removed while the instrument is on.

Chapter 4
Operation Verification

About This Chapter

This Chapter contains procedures for operating verification of the Agilent 3499A/B mainframes and the plug-in modules. This Chapter contains the following sections:

- Generation Information . . . . . Page 45
- Mainframe Self-Test . . . . . Page 46
- Mainframe Verification Tests . . . . . Page 47
- Relay Cycle Count . . . . . Page 48
- MUX Modules Verification Tests . . . . . Page 48
- GP Relay Modules Verification Tests . . . . . Page 49
- Matrix Modules Verification Tests . . . . . Page 51
- Digital I/O Modules Verification Tests . . . . . Page 53
- Agilent 44472A Verification Tests . . . . . Page 55
- Agilent 44476A Verification Tests . . . . . Page 56
- Agilent 44477A Verification Tests . . . . . Page 57
- Agilent 44478A/B Verification Tests . . . . . Page 59

General Information

The Operation Verification Tests should be performed whenever it is desired to determine whether the Agilent 3499A/B and its plug-in modules are actually operating. For example, these tests can be used as an "incoming inspection procedure" when an Agilent 3499A/B Switch/Control System is initially received, or they can be used to verify a suspected failure after the system has been installed into a test system. Additionally, after a failure has been detected and repaired, these tests can be used to confirm that the repairs have accomplished their purpose.

A "test fixture" is required for several plug-in modules to simplify testing and act as an interface between the module and a multimeter. A test fixture can be made for a plug-in module by configuring a removable wiring (screw) terminal block.

The following instruments can be used to perform the Verification Tests:

- Agilent 34401A Digital Multimeter, or equivalent;
- Test Fixture (configured from the related wiring terminal block);
- PC (IBM compatible, with the RS-232 default);
- GPIB Interface.

WARNING **Hazardous voltages may exist on the wiring and connectors of the Agilent 3499A/B plug-in modules. Only service trained personnel should make repairs to the Agilent 3499A/B mainframes and/or the plug-in modules.**

WARNING **Make sure to disconnect all the wiring from the Agilent 3499A/B plug-in modules to the external devices in order to execute the Verification Tests. This presents two potential safety hazardous:**

a: It is possible for the user to come in contact with high voltage (if high voltage exists in the test system).

b: Equipment damage may occur if the wrong lines become accidentally connected or disconnected.

Caution **Use anti-static handling techniques during the Verification Tests.**

Mainframes Self-Test

The Agilent 3499A/B mainframes self-test verifies the operation of the front panel circuitry, and a part of the micro-processor related circuitry (ROM, etc.) on the Controller PC board. In addition, GPIB & RS-232 circuitry on the Controller PC board can also be verified with self-test.

The self-test does not, however, assess the operability of the backplane or the drivers contained in the mainframe. The operability of the backplane or the drivers will not be tested until the individual plug-in modules tests are performed.

It is important to remember that if the self-test passes, it does not, in itself, ensure proper instrument operation. A self-test failure, however, does indicate an instrument malfunction.

Self-Test

To perform a self-test: Press **Menu**, turn the knob to "SELFTEST", then press **Enter**. The self-test should start by turning on all display segments. Following the display test, the internal tests are performed. If all internal tests pass, "PASSED" will be displayed. Otherwise, the reason of the failure will be displayed (see the Table below).

Error Number	Description
+1	ROM test failed.
+2	GPIB test failed.
+3	RS-232 test failed.
+4	Front-panel test failed.

Correction

If, during the display test, a segment or segments malfunctioned, a problem exists on the Controller PC board or the Display assembly. Refer to "Service" on Page 61 for problem isolation information.

If the front-panel test failed, a problem exists on the front panel circuitry; if any of the other internal tests failed, the Controller PC board is malfunctioned. To replace or repair the front panel circuitry and /or the Controller PC board, the mainframe must be disassembled. Refer to "Replaceable Parts" on Page 67 for Agilent 3499A/B mainframes disassembly information.

Mainframe Verification Tests

The mainframe self-test does not assess the operability of the driver circuitry and the connectivity, more operation verification tests are required. These include the GPIB test, the RS-232 test and the keyboard test.

GPIB Test

To test the GPIB on an Agilent 3499A/B mainframe:

1. Make sure the GPIB interface card and the Agilent I/O Library is installed in your PC, and the Agilent 3499A/B interface is set to GPIB;
2. Make sure one or more plug-in modules are installed (i.e. Agilent N2260A, etc.);
3. Make sure the GPIB address is correct and the GPIB cable is operational;
4. Connect the GPIB interface from your PC to an Agilent 3499A/B;
5. Set the Agilent 3499A/B to SCPI mode. Send a SCPI command DIAG:DISP "GPIB test" from you PC.

If "GPIB TEST" is displayed on the front panel of the Agilent 3499A/B, the GPIB test passed. Otherwise, the GPIB test failed.

RS-232 Test

To test the RS-232 on an Agilent 3499A/B:

1. Make sure one or more plug-in modules are installed (i.e. Agilent N2260A, etc.);
2. Set the Agilent 3499A/B to SCPI mode and the Agilent 3499A/B interface is set to RS-232;
3. Connect the RS-232 cable from your PC to an Agilent 3499A/B;
4. Send a SCPI command DIAG:DISP "RS232 test" from you PC.

If "RS232 TEST" is displayed on the front panel of the Agilent 3499A/B, the RS-232 test passed. Otherwise, the RS-232 test failed.

Keyboard Test

All the keys on the front panel of an Agilent 3499A/B can be tested easily by pressing the keys. If one or more keys has no response, a problem exists in either the Keyboard Assembly, or the Controller PC board. Refer to "Service" on Page 61 for problem isolation information.

Correction

If GPIB test and/or RS-232 test failed, the Controller PC board malfunctioned. To replace or repair the Controller PC board, it is necessary to disassemble the Agilent 3499A/B mainframe. Refer to "Replaceable Parts" on Page 67 for the mainframes disassembly information.

Relay Cycle Count

For the plug-in modules Agilent N2260A/61A/62A, and the switching function on the multifunction modules Agilent N2264A/65A, the relay cycle count can be queried from the front panel (refer to "Front-Panel Operation" on Page 21 for the operation).

It is recommended that the switching module can be replaced with a new one, if the relay cycles of the switching relay(s) on this module exceed the relay life. Refer to "Specifications" on Page 1 for more information.

MUX Modules Verification Tests

The MUX modules available with an Agilent 3499A/B include:

- Agilent N2260A 40-channel MUX module;
- Agilent 44470A 10-channel MUX module;
- Agilent 44470D 20-channel MUX module.

Test Fixture

In order to perform the Operation Verification Tests for a MUX module, a test fixture is required and it can be constructed by configuring the related MUX module's removable wiring terminal block as shown in Figure 4-1.

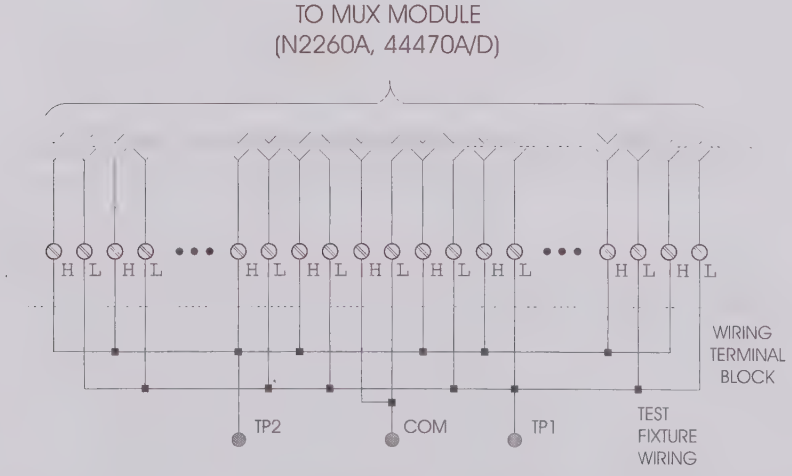


Figure 4-1. MUX Modules Test Fixture

The fixture contains:

- A short circuit between all of the low (L) lines (TP1);

- A short circuit between all of the high (H) lines (TP2);
- A short circuit between the shorted common lines (COM).

With the test fixture installed, and a Multimeter (i.e. an Agilent 34401A) connected between the shorted common lines (COM) and either the shorted low lines (TP1) or the shorted high lines (TP2), the MUX module is tested by successively closing each relay while checking for an indication of the closure on the Multimeter.

Tests Procedure

To perform the Operation Verification Tests:

1. Remove the wiring terminal block from the MUX module;
2. Install the related test fixture onto the MUX module;
3. Set the Multimeter to measure resistance. "Zero" the Multimeter;
4. Press **Mon** and specify the slot occupied by the MUX module;
5. Press **S.LIST** and specify all channels on the MUX to be scanned;
6. Connect the Multimeter between COM & TP1 (or COM & TP2) on the test fixture (Figure 4-1 on Page 48);
7. Press **Card Reset** to reset the MUX module, the Multimeter should indicate that all relays are open (very high resistance or overload indication);

Note If the Multimeter is indicating a very low resistance, one or more of the relays is remaining closed. You need to do more tests to isolate the clumsy damaged relay(s).

8. Successively press **Step** while observing the displays on the Agilent 3499A/B and the Multimeter. The Agilent 3499A/B's display should show a number corresponding to the closed relay. The clumsy damaged relay(s) can be isolated in this way.

Correction

If during Step 8, one or more relays did not close as described, a problem exists either in the Controller PC board or the related MUX module. Replace this MUX with another same one and perform the tests as described above to isolate the problem.

If during step 8, the appropriate relays closed, but one or more of the resistances were higher than 1 Ω, the corresponding relay(s) are defective.

If a MUX module is defective, replace it with a new one (the relays are not replaceable parts, refer to Chapter 6: Replaceable Parts on Page 67 for more information).

GP Relay Modules Verification Tests

The GP Relay modules available with an Agilent 3499A/B include:

- Agilent N2261A 40-channel GP Relay module;
- Agilent 44471A 10-channel GP Relay module;
- Agilent 44471D 20-channel GP Relay module;

- Agilent N2264A Multifunction (GP function).

Test Fixture

The test fixture can be constructed by configuring the related GP Relay module's removable wiring terminal block as shown in Figure 4-2.

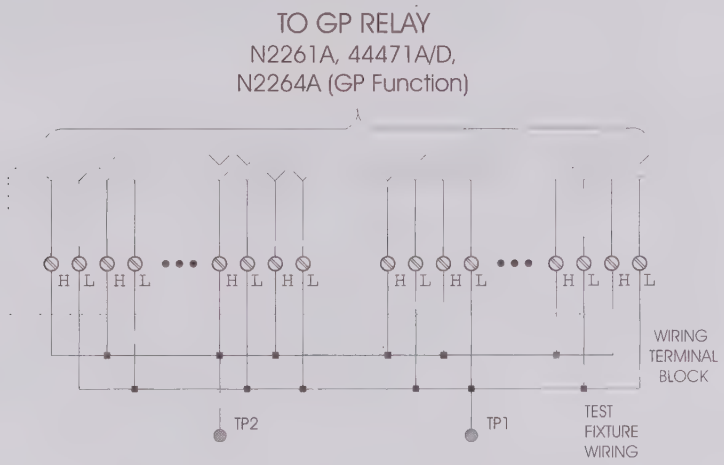


Figure 4-2. GP Relay Modules Test Fixture

The fixture contains:

- A short circuit between all of the low (L) lines (TP1);
- A short circuit between all of the high (H) lines (TP2).

With the test fixture installed, and a Multimeter (i.e. an Agilent 34401A) connected between the shorted low lines (TP1) and the shorted high lines (TP2), the GP Relay module is tested by successively closing each relay while checking for an indication of the closure on the Multimeter.

Tests Procedure

To perform the Operation Verification Tests:

1. Remove the wiring terminal block from the GP Relay module;
2. Install the related test fixture onto the GP Relay module;
3. Set the Multimeter to measure resistance. "Zero" the Multimeter;
4. Press **Mon** and specify the slot occupied by the GP Relay module;
5. Press **S.LIST** and specify all channels to be scanned;
6. Connect the Multimeter between TP1 & TP2 on the test fixture (Figure 4-2);.
7. Press **Card Reset** to reset the GP Relay module, the Multimeter should indicate that all relays are open (very high resistance or overload indication);

Note If the Multimeter is indicating a very low resistance, one or more of the relays is remaining closed. You need to do more tests to isolate the clumsy damaged relay(s).

8. Successively press **Step** while observing the displays on the Agilent 3499A/B and the Multimeter. The Agilent 3499A/B's display should

show a number corresponding to the closed relay. The clumsy damaged relay(s) can be isolated in this way.

Correction

If during Step 8, one or more relays did not close as described, a problem exists either in the Controller PC board or the related GP Relay module. Replace this GP Relay with another same one and perform the tests as described above to isolate the problem.

If during step 8, the appropriate relays closed, but one or more of the resistances were higher than the Initial Closed Channel Resistance (refer to Chapter 1: Specifications on Page 1), the corresponding relay is defective.

If the GP Relay module is defective, replace it with a new one (the relays are not replaceable parts, refer to Chapter 6: Replaceable Parts on Page 67 for more information).

Matrix Modules Verification Tests

The Matrix modules available with the Agilent 3499A/B include:

- Agilent N2262A 4 x 8 2-wire Matrix module;
- Agilent 44473A 4 x 4 2-wire Matrix module;
- Agilent N2265A Multifunction module (4 x 4 2-wire Matrix).

Test Fixture

The test fixture can be constructed by configuring the related Matrix module's removable wiring terminal block as shown in Figure 4-3.

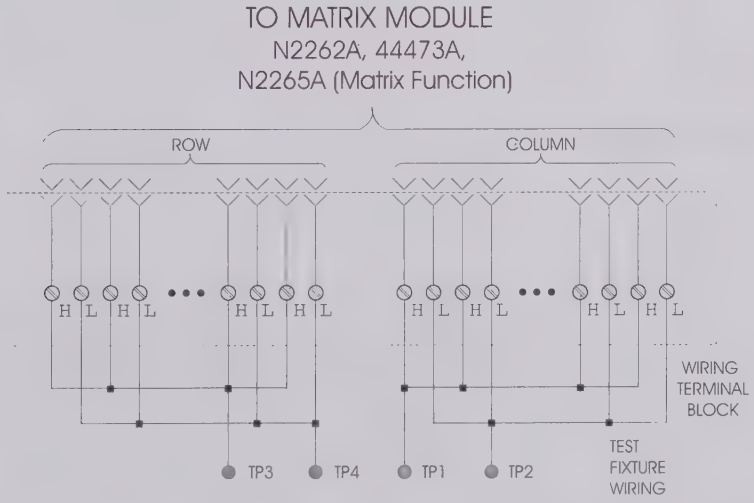


Figure 4-3. Matrix Modules Test Fixture

The fixture contains:

- A short circuit between all of the high lines in the Columns (TP1);

- A short circuit between all of the low lines in the Columns (TP2);
- A short circuit between all of the high lines in the Rows (TP3);
- A short circuit between all of the low lines in the Rows (TP4).

With the test fixture installed, and a Multimeter (i.e. an Agilent 34401A) connected between the Columns and the Rows, the related Matrix module is tested by successively closing each relay while checking for an indication of the closure on the Multimeter.

Tests Procedure

To perform the Operation Verification Tests:

1. Remove the wiring terminal block from the Matrix module;
2. Install the related test fixture onto the Matrix module;
3. Set the Multimeter to measure resistance. "Zero" the Multimeter;
4. Press **Mon** and specify the slot occupied by the Matrix module;
5. Press **S.LIST** and specify all channels to be scanned;
6. Connect the Multimeter between TP1& TP3 (or TP2 & TP4) on the test fixture (Figure 4-3 on Page 51);
7. Press **Card Reset** to reset the Matrix module, the Multimeter should indicate that all relays are open (very high resistance or overload indication);

Note If the Multimeter is indicating a very low resistance, one or more of the relays is remaining closed. You need to do more tests to isolate the clumsy damaged relay(s).

8. Successively press **Step** while observing the displays on the Agilent 3499A/B and the Multimeter. The Agilent 3499A/B's display should show a number corresponding to the closed relay. The clumsy damaged relay(s) can be isolated in this way.

Correction

If during Step 8, one or more relays did not close as described, a problem exists either in the Controller PC board or the related Matrix module. Replace this Matrix with another same one and perform the tests as described above to isolate the problem.

If during Step 8, the appropriate relays closed, but one or more of the resistances were higher than 1Ω, the corresponding relay is defective.

If the Matrix module(s) is defective, replace it with a new one (the relays are not replaceable parts, refer to Chapter 6: Replaceable Parts on Page 67 for more information).

Digital I/O Modules Verification Tests

Four digital I/O (DIO) modules are available with the Agilent 3499A/B:

- Agilent 44474A 16-bit DIO module;
- Agilent N2263A 32-bit DIO module;
- Agilent N2264A Multifunction module (16-bit DIO Function);
- Agilent N2265A Multifunction module (16-bit DIO Function).

Test Fixture

The test fixture can be constructed by configuring the related DIO module's removable wiring terminal block as shown in Figure 4-4.

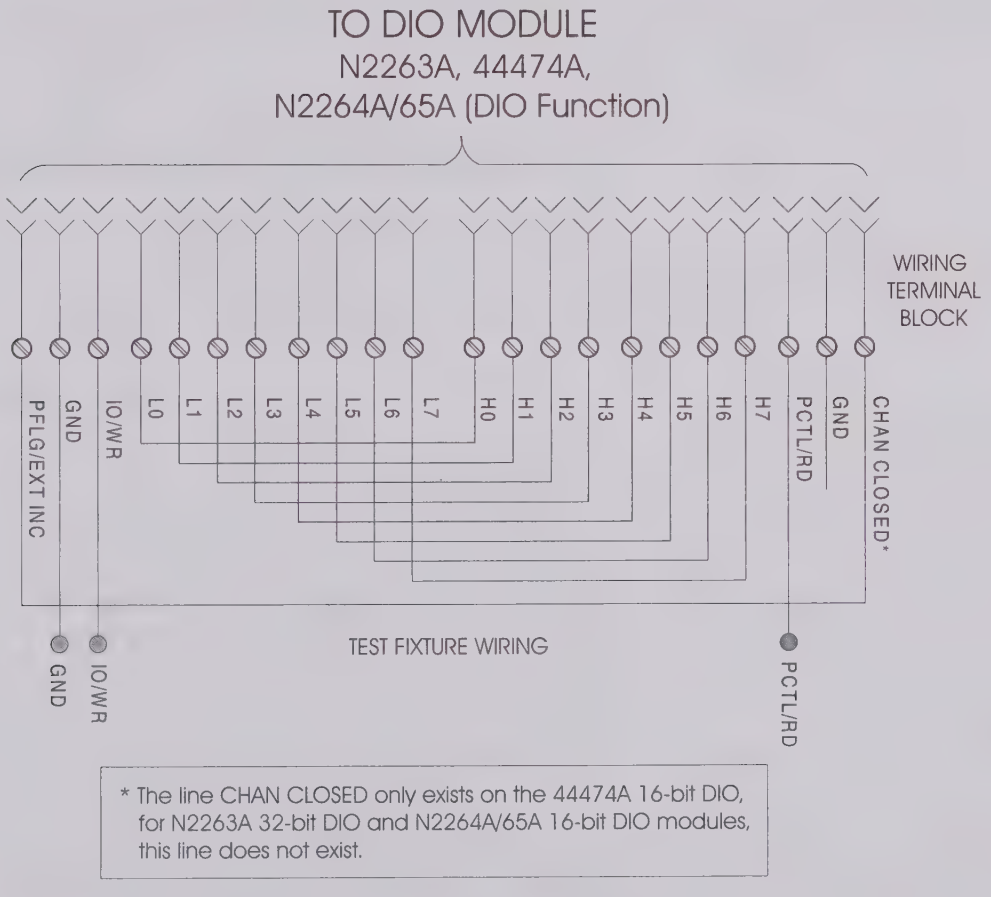


Figure 4-4. DIO Modules Test Fixture

This fixture is applicable for the Agilent 44474A 16-bit DIO. For Agilent N2263A/64A/65A, the line CHAN CLOSED does not exist. For Agilent N2263A 32-bit DIO, the related data lines (i.e. the first bit in ports s00, s01, s02 and s03, and so on) in each of the four 8-bit ports are connected together to simplify the data lines testing.

Tests Procedure

The Verification Tests for a DIO module consist of:

a. Data lines input/output tests;
b. The CHAN CLOSED[1] and PFLG/EXT INC tests;
c. The IO/WR and PCTL/RD tests.

Data Lines Input/Output Tests Procedure:

1. Remove the wiring terminal block from the DIO module and install the related test fixture onto it;
2. Press **Card Reset** to reset the DIO module, all the ports in this module should be input (DIN). Press **Mon**, the display should be "DIN 11111111 snn" or "DIN 255 snn", where s = slot number, and nn is the related port number;
3. Write a binary 10101010 to any one of the 8-bit ports (in order to open every other line) and verify the data has been transferred to all the other ports.

   Take an Agilent N2263A for example, if a data (10101010) has been written to the port s02, this data should be transferred to other ports s00, s01 and s03. When these ports (s00, s01 & s03) are monitored, the display should be 10101010 (binary) or 170 (decimal). If it does not, a problem exists on this DIO module.

Note

You can write any other data to one port to verify the data lines.

Chan Closed and PFLG/EXT INC Tests Procedure

1. Reset the DIO module and create a scan list including all the bits on this module;
2. Press **Step**. If the CHAN CLOSED (Agilent 44474A only) and/or PFLG/EXT INC lines are functioning, the Agilent 3499A/B will begin stepping through the scan list, opening each data line as it closes the previous line. This will be shown on the Agilent 3499A/B's display as the first 8-bit port being successively decreased by the binary weighted value of each data line. In other words, the display will start with the value of 255, step to 254 (binary 1), step to 253 (binary 2), step to 251 (binary 4), step to 247 (binary 8), step to 239 (binary 16), step to 223 (binary 32), step to 191 (binary 64) and finally, step to 127 (binary 128). When all eight data lines in this port have been stepped through, the port will reset to 255 and the process will repeat with the second 8-bit port, and so on.

If the scan list will not automatically advance as described above, the CHAN CLOSED line, the PFLG/EXT INC line, or both are malfunctioning.

IO/WR and PCTL/RD Tests Procedure

1. Reset the DIO module;
2. Connect the Multimeter between the GND and the PCTL/RD (or IO/WR) terminals on the test fixture (Figure 4-4 on Page 53) to

1. The line Channel Closed is for the Agilent 44474A 16-bit DIO only.

measure dc voltage. The PCTL/RD (or IO/WR) line should be in the high state (between +2.4 V dc and +5 Vdc);

3. Change the polarities of the IO/WR and PCTL/RD to negative (NEG), and write a data to any one of the 8-bit ports on the DIO module (for more instructions, refer to "Front-Panel Operation" on Page 21);
4. Measure the voltage between the GND and the IO/WR (or PCTL/RD) terminals. The IO/WR (or PCTL/RD) line should be in the low state (between 0 Vdc and +0.4 V dc).

If either or both control lines failed to achieve either or both states, a problem exists in either the mainframe Controller PC board or the plug-in DIO module. You can isolate the problem by testing the same items described above with another (same type) functional DIO module.

Correction

Replace the DIO module with a new one if it is failed.

Agilent 44472A Verification Tests

The VHF Switch module consists of two 4-to-1 MUXs with BNC connections. Only the center conductor of each channel is switched. The outer conductors (shield) of all channels in a particular MUX are connected together and unswitched.

Tests Procedure

To test a channel:

1. Remove any external wiring from the rear of the 44472A. Reset the 44472A and press **Mon**;
2. Set the Multimeter to measure resistance, "Zero" the Multimeter;
3. Create a scan list including all the channels of 44472A;
4. **MUX #0 TESTS:** Connect a Multimeter between the center conductor of the common connector (common #0) and the center conductor of the channel under test (channel 00 to start). The Multimeter should indicate that the channel is open (very high resistance or an overload indication);
5. Press **Step**, the Multimeter should display a resistance reading of less than 1Ω;
6. Repeat Steps 4 and 5 for channels 01, 02 and 03;
7. **MUX #1 TESTS:** Reset the 44472A and connect the Multimeter between the center conductor of the common connector (common #1) and the center conductor of the channel under test (channel 10 to start). The Multimeter should indicate that the channel is open (very high resistance or an overload indication);
8. Press **Step** until the channel under test appears in the Agilent 3499A/B's display. The Multimeter should display a resistance reading of less than 1Ω;
9. Repeat Steps 7 and 8 for channels 11, 12 and 13.

Correction

a. If during Steps 5 or 8, one or more channels does not close as described, a problem exists in either the mainframe Controller PC board or the 44472A. You can use a functional 44472A to isolate the problem.

b. If during Steps 5 or 8, the channels closed but one or more of the resistances was greater than 1Ω, the relays in the corresponding channel(s) are failing.

Note To replace the 44472A with a new one if it is failing.

Agilent 44476A/B Verification Tests

The Agilent 44476A has three independent SPDT 50 Ω coaxial switches (Figure 4-5). The Agilent 44476B allows you to mount any two 3331XX Coaxial Switches; these coaxial switches come in 3/4/5-port configurations. To verify that the 33311B Coaxial Switches on the Agilent 44476A (or the switches you provide on the Agilent 44476B) are functioning, verify continuity between the common port and the port connected to it. Also, verify there is no continuity between the common port and any unconnected ports.

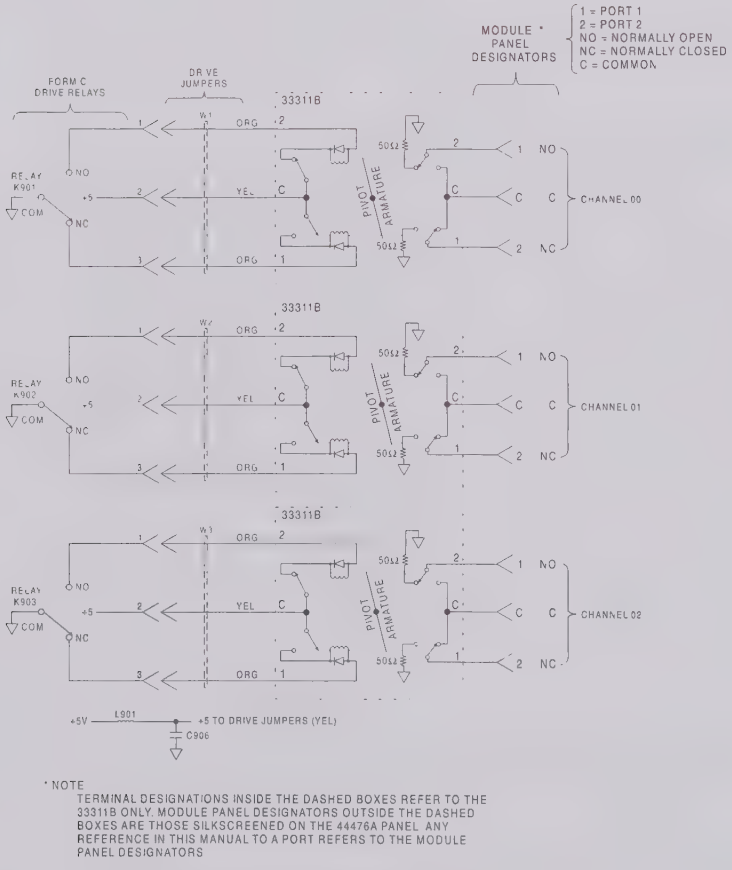


Figure 4-5. Agilent 44476A Simplified Schematic

Note The Agilent 44476B simplified schematic is the same as the Agilent 44476A's, with the exception of that the three Microwave modules (33311B) are not installed.

Tests Procedure

To perform the Verification Tests for an Agilent 44476A/B:

1. Reset the module (Agilent 44476A/B) and press **Mon**;
2. Using the Multimeter, verify continuity between the Channel 00 center conductor of the common port (C) and center conductor port 1 (1). For an Agilent 44476B, you must determine which ports should have continuity for Channel 00 and verify it;
3. Verify there is no continuity between the common port and ports that should not be connected to the common port;
4. Repeat Steps 2 & 3 to verify the other channels;
5. Close all the channels on the Agilent 4476A/B;
6. Verify continuity between the Channel 00 center conductor of the common port and center conductor of port 2. For an Agilent 44476B, you must determine which ports should have continuity for Channel 00 and verify it;
7. Verify there is no continuity between the common port and port 1 of channel 00. For the Agilent 44476B, you must determine which ports should not have continuity and verify they do not;
8. Repeat Steps 6 & 7 to verify other channels.

Correction

If a Microwave Switch does not function properly, you must determine if the problem is caused by the drive circuity or drive relays K901, K902, or K903. Use another same functional Microwave Switch and perform the same tests as described above to isolate the problem.

The three Microwave Switches are replaceable parts, if any one of them is defective, replace it with a new one. If the drive circuity or drive relays are defective, replace the Agilent 44476A/B with a new one (with the exception of the Microwave Switches if they are functioning).

Agilent 44477A Verification Tests

Agilent 44477A contains seven independent, single-pole double-throw (SPDT) Form C relays. When a channel is open, the normally closed (NC) will connect to the common (C). When a channel is closed, the normally open (NO) will connect to the common (C).

Test Fixture

A test fixture can be configured by connecting all relay commons (C) together at TP1, all normally open (NO) contacts at TP2 and all normally closed (NC) contacts together at TP3, with an Agilent 44487A screw terminal block.

Tests Procedure

To verify that all relays are functioning properly, you must:

a. Verify that each relay can close the normally open (NO) contact;
b. Verify that each relay's normally closed (NC) contact operates properly.

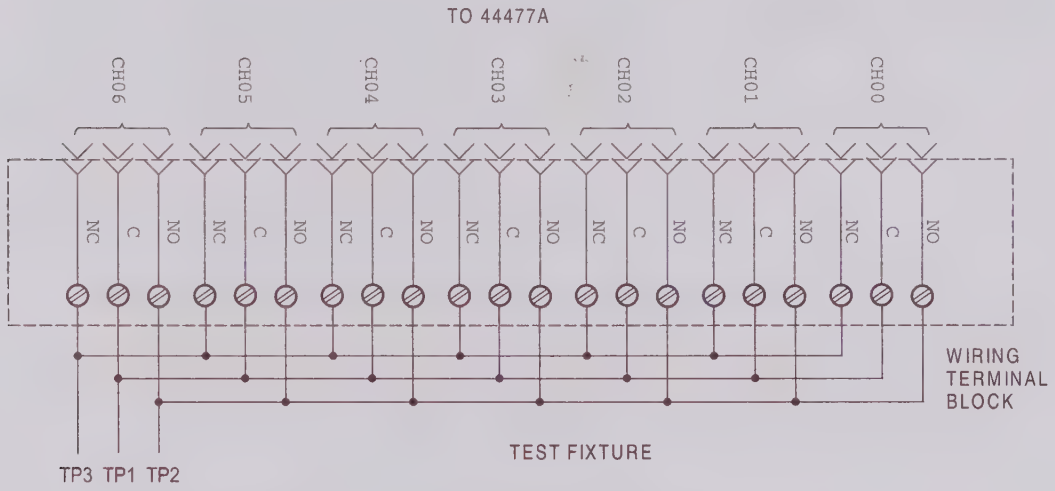


Figure 4-6. Agilent 44477A Test Fixture

To Verify the NO Contacts:

1. Connect a Multimeter between TP1 (C) & TP2 (NO), reset the Agilent 44477A. The Multimeter should show an open circuit;
2. Close Channel 00 and check the Multimeter for an indication of closure. This reading will be the closed channel resistance of the NO contact and should be less than 1Ω;
3. Open Channel 00 and close Channel 01, check for an open circuit when Channel 00 is opened, and an indication of closure when Channel 01 is closed;
4. Repeat Steps 2 & 3 to check the remaining Channels 02-06.

To Verify the NC Contacts:

5. Connect the Multimeter between TP1 (C) & TP3 (NC), reset the Agilent 44477A. The Multimeter should show an open circuit;
6. Repeat Steps 2 through 4 to verify the NC contacts (the "NO" in Steps 2-4 should be replaced with "NC", respectively).

Correction

If during Steps 1 & 5, one or more relays does not function properly, a problem exists either in the Controller PC board or in the Agilent 44477A, use a functional Agilent 44477A and perform the same tests to isolate the problem.

If during Steps 3 & 6, the Agilent 44477A is functioning but the contact resistance is more than 1Ω, the Agilent 44477A is defective. Replace the Agilent 44477A with a new one in this case.

Agilent 44478A/B Verification Tests

Agilent 44478A/B consists of two 4-to-1 MUXs (Group 00 & Group 10) that can switch signals bidirectionally. Each group has a separate ground for isolation between groups and this ground is unswitched (Figure 4-7).

To verify that the relays in each group are functioning, verify continuity between the center conductor of the common BNC and each channel's BNC center conductor when that channel is closed. If no continuity exists, verify that a relay is stuck open and continuity exists from the channel's BNC center conductor and the channel's associated SMB (J101-J110) center conductor when the channel is open.

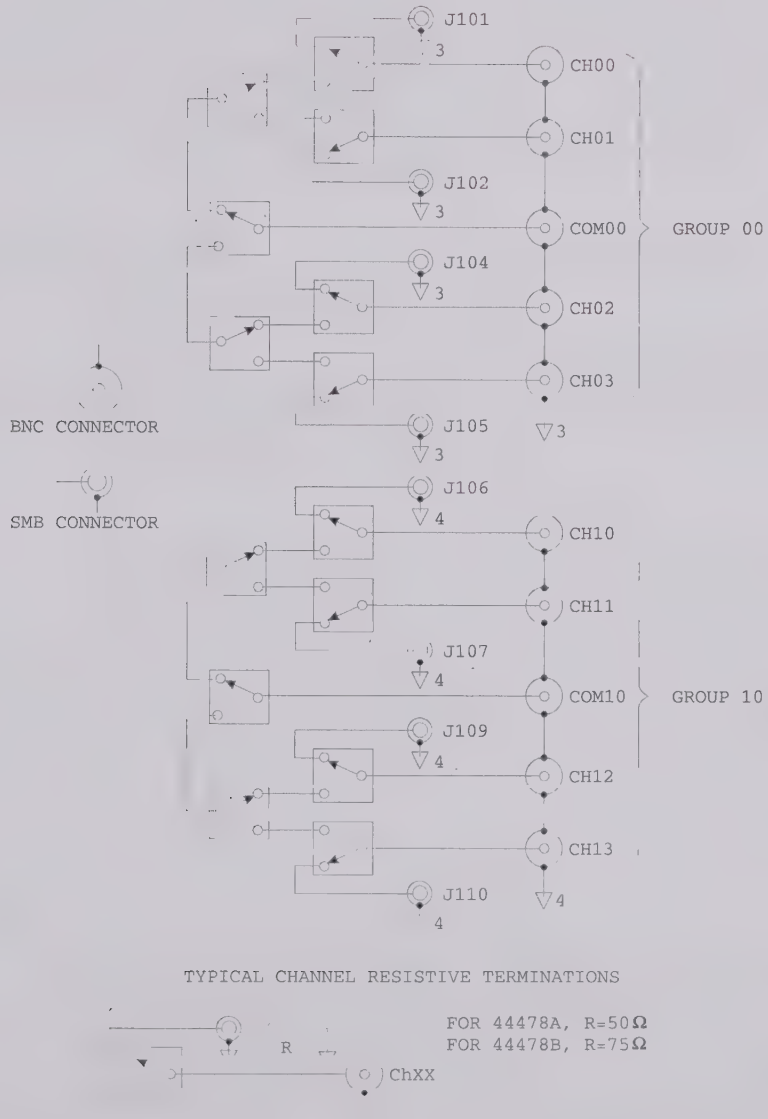


Figure 4-7. Agilent 44478A/B Simplified Schematic

Tests Procedure

To verify that the relays in each group are functioning:

1. Remove any external wiring from the Agilent 44478A/B connectors;
2. Reset the Agilent 44478A/B and press **Mon**;
3. Create a scan list including all the channels on an Agilent 44478A/B;
4. Connect the Multimeter between the center conductor of the COM 00 connector and the center conductor of the channel under test (start with CH 00). The Multimeter should indicate the channel is open (very high resistance or an overload indication);
5. Press **Step**, the Multimeter should display a resistance of less than 1Ω;
6. Repeat Steps 4 & 5 for Channels 01, 02 and 03;
7. Connect the Multimeter between the center conductor of the COMM 00 connector and the center conductor of the channel under test (start with CH 10. The Multimeter should indicate the channel is open;
8. Press **Step**, the Multimeter should display a resistance of less than 1Ω;
9. Repeat Steps 7 & 8 for Channels 11, 12 and 13.

Correction

If during Steps 4 & 7, one or more relays does not function, a problem exists either in the Controller PC board or in the Agilent 44478A/B. Use a functional Agilent 44478A/B and perform the same tests to isolate the problem.

If during Steps 5 & 8, the resistance when the channel is closed is more than 1Ω, one or more relays on this channel is defective. Replace the Agilent 44478A/B with a new one in this case.

Chapter 5
Service

Introduction

This Chapter provides general service related information about the Agilent 3499A/B Switch/Control System. This includes safety considerations, static-handling procedures, and problem isolation processes. Chapter contents include:

- Safety Considerations . . . . . Page 61
- Static Handing. . . . . Page 61
- Agilent 3499A/B Problem Isolation . . . . . Page 62
- Mainframe Problem Isolation . . . . . Page 63

Safety Considerations

Only service trained personnel should attempt to repair the Agilent 3499A/B. There are two places in the Agilent 3499A/B where dangerous voltages may exist. The ac line voltage exists in the Agilent 3499A/B mainframe around the areas of the line input filter, line power switch and the power supply assembly. This potentially lethal voltage can only be contacted if the covers are removed.

The other potentially lethal voltage may exist at the plug-in module wiring terminal block. This voltage is generated externally to the Agilent 3499A/B. Consult the system installer before attempting to remove the Agilent 3499A/B and its plug-in modules from the system.

WARNING **Only personnel with a knowledge of electronic circuitry and an awareness of the hazards involved should install, reconfigure, or make any repairs to the Agilent 3499A/B mainframe or its plug-in modules.**

Static Handing

Static electricity is a familiar phenomenon which, except for an occasional shock, doesn't seem very serious. However, it has been proven that in the electronics industry electrostatics discharge (ESD) is a major cause of component failure. In many cases, the component damaged may not immediately fail, causing low instrument reliability and unnecessary repairs at a later time. ESD damage can occur at static levels too low for human perception. Additionally, it has been shown that ESD can affect both passive and active devices.

Any assembly or subassembly removed from the mainframe MUST be handled in accordance with anti-static handing procedures.

The following guidelines are the minimum requirements for a static safe service environment.

- The work bench should be equipped with a conductive table mat. The mat should be grounded to earth ground through a 1 MΩ resistor. The mat should be equipped with at least one swivel connected to the swivel connector for connecting wrist straps.
- All service and handling personnel should wear a conductive wrist strap in contact with bare skin. This strap should be connected to the swivel connector on the conductive table mat through a 1 MΩ resistor.
- All metal equipment at a work station must be grounded. This includes soldering irons, solder suckers, shelving, and equipment stands.
- Only one common ground should be provided at a workstation.
- The workstation must be kept free of nonconductors. No common plastics, polybags, cardboard, cigarette or candy wrappers should be allowed. There should not be rugs or carpet on the floor, shelving, or bench top.
- Only proper containers should be used for shipping, storing and transporting assemblies.

Caution **To prevent equipment circuit damage, always set the line power switch to off before removing or replacing any assembly.**

Caution **Always use anti-static techniques when assemblies are handled or serviced.**

Agilent 3499A/B Problem Isolation

An Agilent 3499A/B Switch/Control System consists of two widths of mainframes and a set of plug-in modules. Once the Agilent 3499A/B is suspected of a failure, a problem should be existing either in the mainframe or in the plug-in modules or in both of them. More tests must be performed to isolate the problem.

Preliminary Tests

Once the Agilent 3499A/B is suspected of a failure:

1. Power off the Agilent 3499A/B and remove all the plug-in modules;
2. Cycle power on the Agilent 3499A/B. If the same problem exists, the problem is mostly on the mainframe; if the problem is solved, the problem may be caused by one or more plug-in module.

Plug-in Module Substitution

The easiest and fastest method to isolate a failure to a particular assembly is the board substitution technique. The technique calls for the suspected bad board to be replaced with a known good board. If the problem is solved, the replaced board or assembly had the problem.

A limited substitution may be performed to isolate a faulty plug-in module. To use this method:

1. Determine which plug-in module is suspected of the failure;
2. Try the failing module in another mainframe slot.

If the module functions normally in other slot, a mainframe failure is indicated; if the module still fails, try a known good module. If the known good module does not function properly, a mainframe failure is indicated; if the module does function properly, a failure in the suspected module is indicated.

Mainframe Problem Isolation

Once an Agilent 3499A/B mainframe is suspected of a failure, the problem may be further isolated within the mainframe to a particular assembly. Isolating a problem within a mainframe requires that the Agilent 3499A/B mainframe be disassembled. A disassembly procedure is given in the next Chapter (refer to "Replaceable Parts" on page 67).

There are four main electronic assemblies within an Agilent 3499A/B mainframe. These include:

1. The Power Supply;
2. The Controller;
3. The Keyboard & Display;
4. The Backplane.

Power Supply

The Power Supply assembly is located behind the keyboard. There are three connectors on it: J1 through J3. J1 is connected to the ac power line and J3 is the safety ground terminal. J2 is connected to the mainframe's backplane, which provides a set of voltages (dc) to the Controller pc board and the plug-in modules.

To determine if the power supply is functioning properly:

1. Make sure the ac power line are connected properly and the fuse (3.15 A @ 250 V ac) on the pc board is well;
2. Power on the instrument and measure the voltage between Pin 4 (or Pin 5) and Pin 1 (or 2, 3, 6);
3. If the voltages are correct, the power supply does function; if the voltage is not correct, a problem exists in this assembly.
4. If the voltages on the J2 are correct, but the voltages on the backplane are incorrect, check the cable (03499-61004) and the plug-in modules. You can perform more tests to further isolate the problem to

the cable, or the particular plug-in module.

Figure 5-1. Power Supply on the Agilent 3499A/B

Controller

Isolating a problem to the Controller pc board is best accomplished by substituting a known good board. The Controller is not repairable and should be replaced if it fails.

Battery Check and Replacement

The battery on the Controller provides power (+3V) to the stored states, etc. and has an expected life of approximately 4 years. The battery voltage can be measured with a Multimeter. It is recommended that the battery can be replaced when the voltage is below 2.7V.

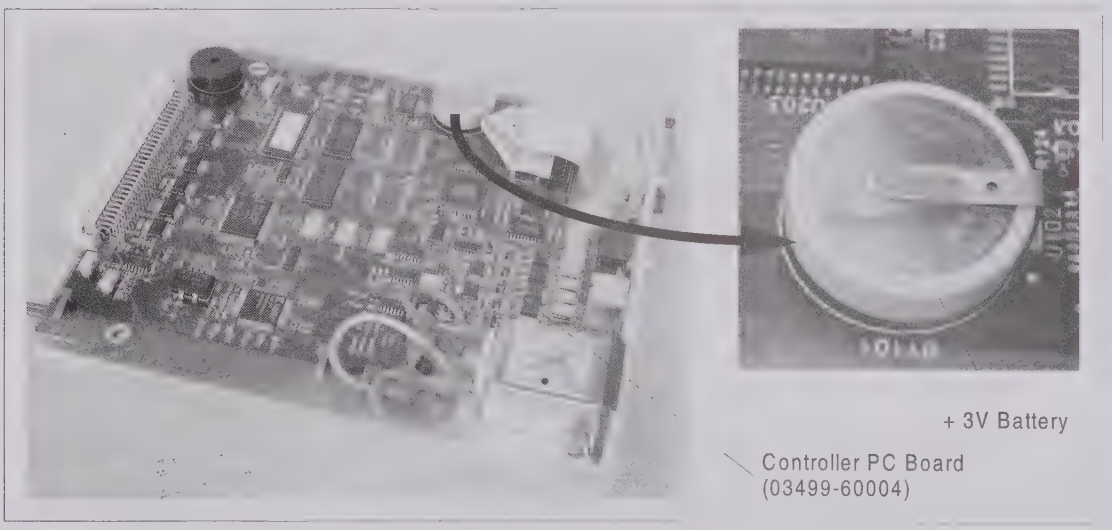


Figure 5-2. Battery on the Controller PC Board

Keyboard & Display

Problems in the keyboard can be isolated by performing the keyboard test. No response to a key closure is the typical failure mode of the keyboard. No response to any key closure would indicate a Controller pc board failure.

Problems in the display can usually be detected by performing the display test (i.e. self-test). Typically, a failing display will exhibit missing segments. Display removal is described in the next Chapter (refer to "Replaceable Parts" on page 67).

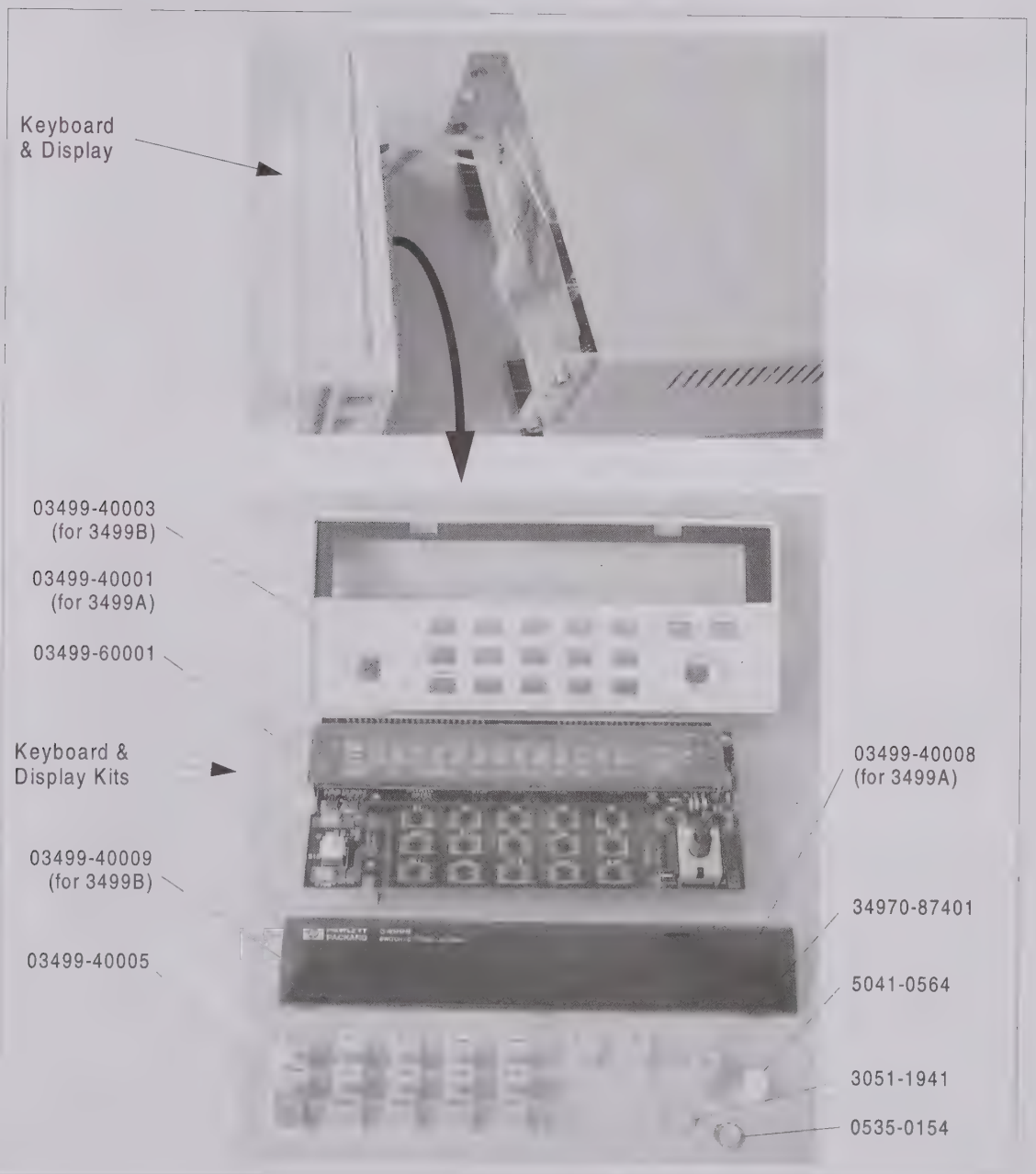


Figure 5-3. Keyboard & Display on an Agilent 3499A/B

Backplane

If a plug-in module will not function in only one slot, the backplane board should be suspected. Connector failure on the backplane board will be the most common form of backplane failures (for there are few components on the backplane). Because the plug-in module slots are all parallel on the backplane, a shorted connector on the backplane board may appear to be a Controller pc board failure.

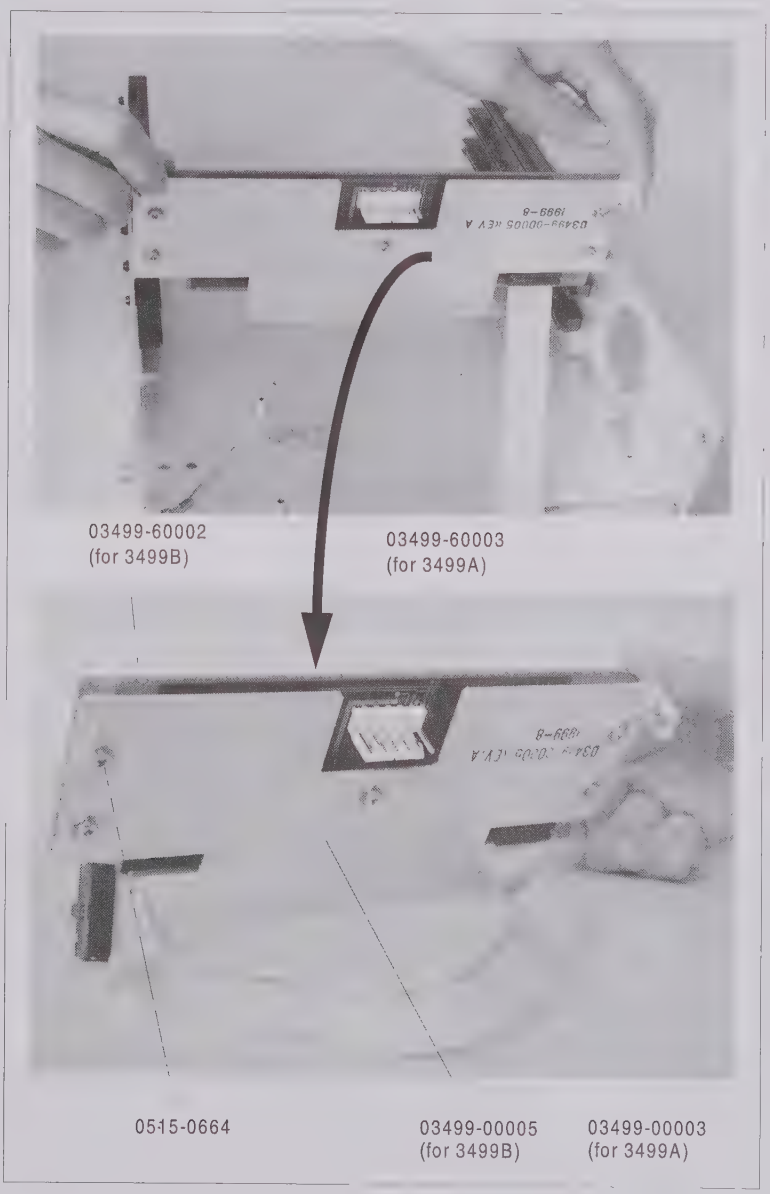


Figure 5-4. Backplane Assembly

Chapter 6
Replaceable Parts

Introduction

This Chapter contains the disassembly/assembly procedures for an Agilent 3499A/B mainframe, followed by the mechanical and electrical replaceable parts for the Agilent 3499A/B mainframe, and its plug-in modules. This Chapter contains the following sections:

- Agilent 3499A/B Disassembly/Assembly Procedures ..... Page 67
- Agilent 3499A/B Mainframe Replaceable Parts..... Page 67
- Plug-in Modules Replaceable Parts ..... Page 74

Agilent 3499A/B Disassembly/Assembly Procedures

WARNING **The line power cord and all other interconnections must be removed before performing any disassembly or assembly procedures.**

Caution **The Agilent 3499A/B mainframe, as well as the plug-in modules, are susceptible to static discharges. Use the anti-static techniques when assemblies are handled or serviced.**

Disassembly Procedures

To disassemble an Agilent 3499B half-rack-width mainframe, perform the following procedures (STEP 1 through STEP 6). For an Agilent 3499A full-rack width mainframe, the disassembly procedures are the same with exception of some different replaceable parts, i.e. the Backplane, the Front-Panel (part), the Rear Bezel, etc.

Figure 6-1 through Figure 6-6 demonstrate the disassembly procedures for an Agilent 3499A/B mainframe. The replaceable parts on it are identified with a number and listed in Table 6-1 on page 72.

Note The replaceable parts for the Agilent 3499A/B plug-in modules are listed in Table 6-2 on page 74.

STEP 1: Front-Panel Removal

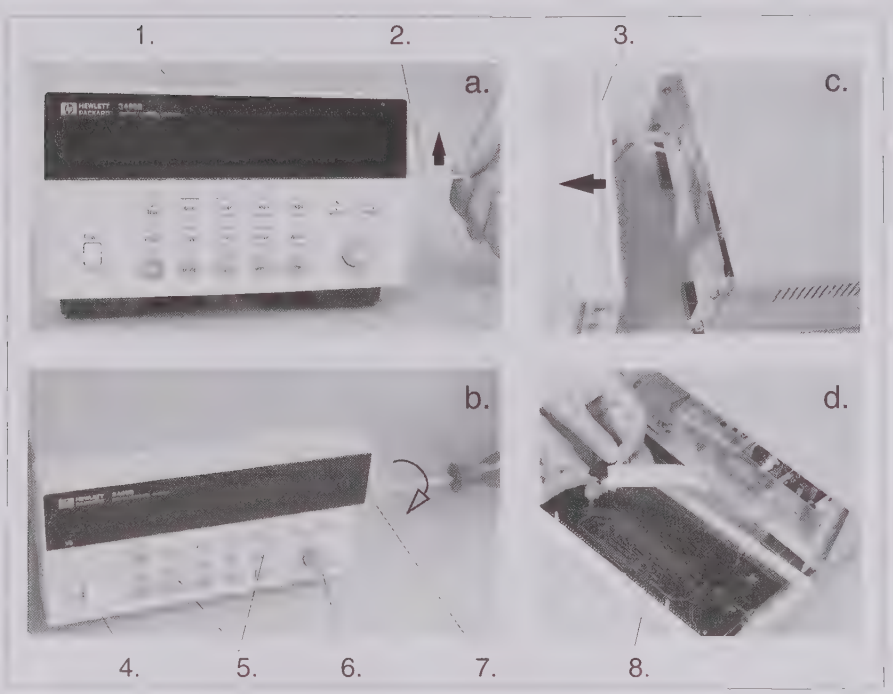


Figure 6-1. Front-Panel Removal

Figure 6-2 shows the Front-Panel disassembling procedures.

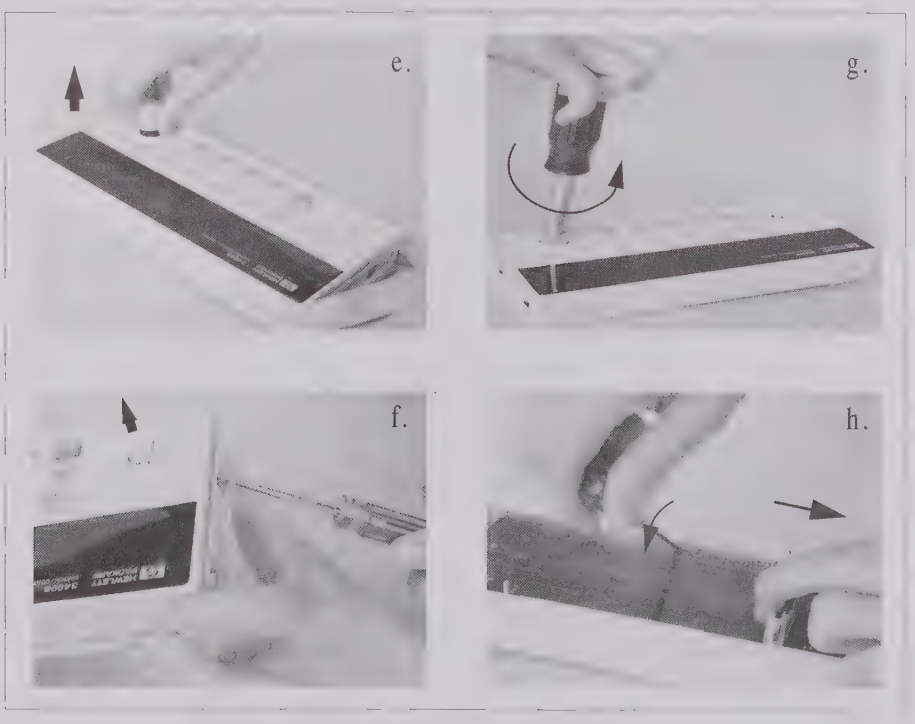


Figure 6-2. Front-Panel Disassembly

STEP 2: Cover Removal

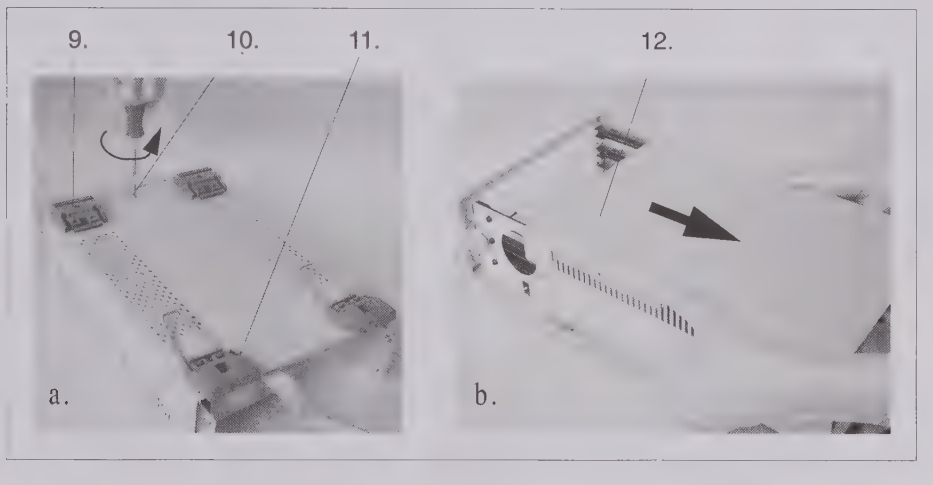


Figure 6-3. Cover Removal

STEP 3: Power Supply Removal

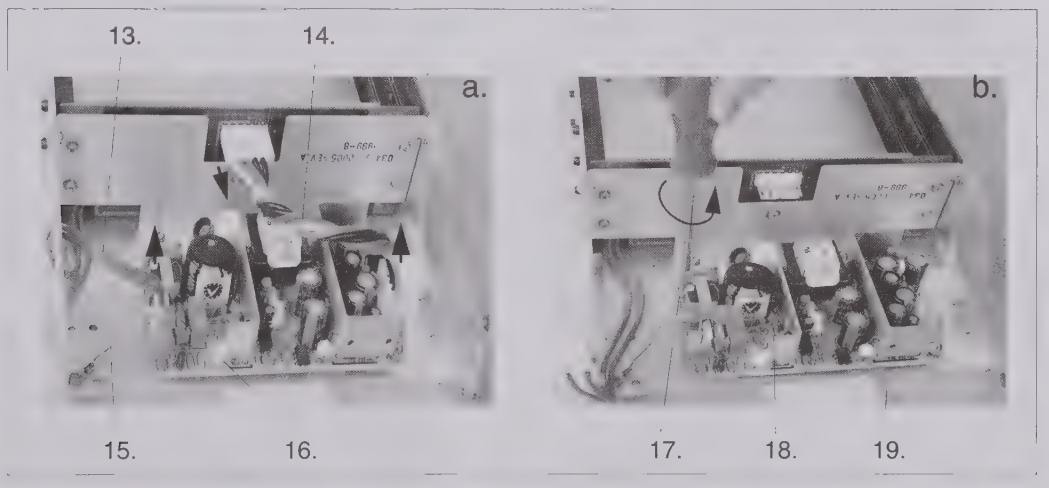


Figure 6-4. Power Supply Removal

STEP 4: Controller PC Board Removal

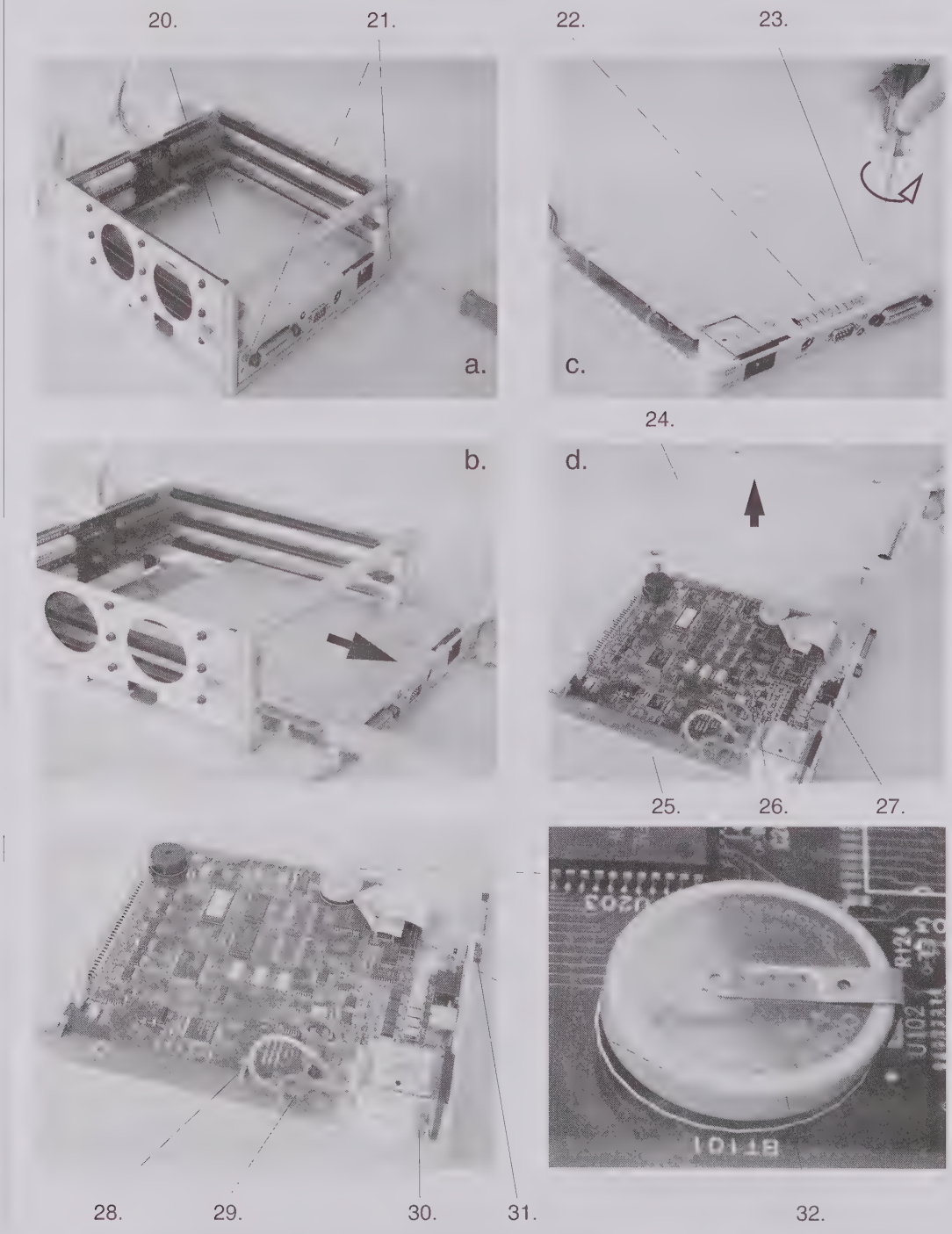


Figure 6-5. Controller PC Board Removal

STEP 5: Rear Bezel Removal

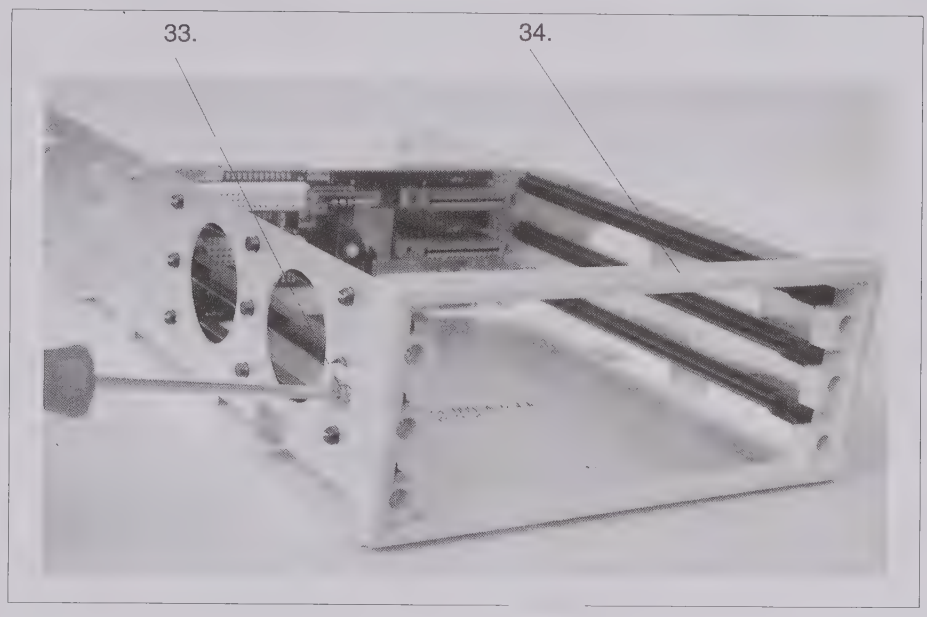


Figure 6-6. Rear Bezel Removal

STEP 6: Backplane Removal

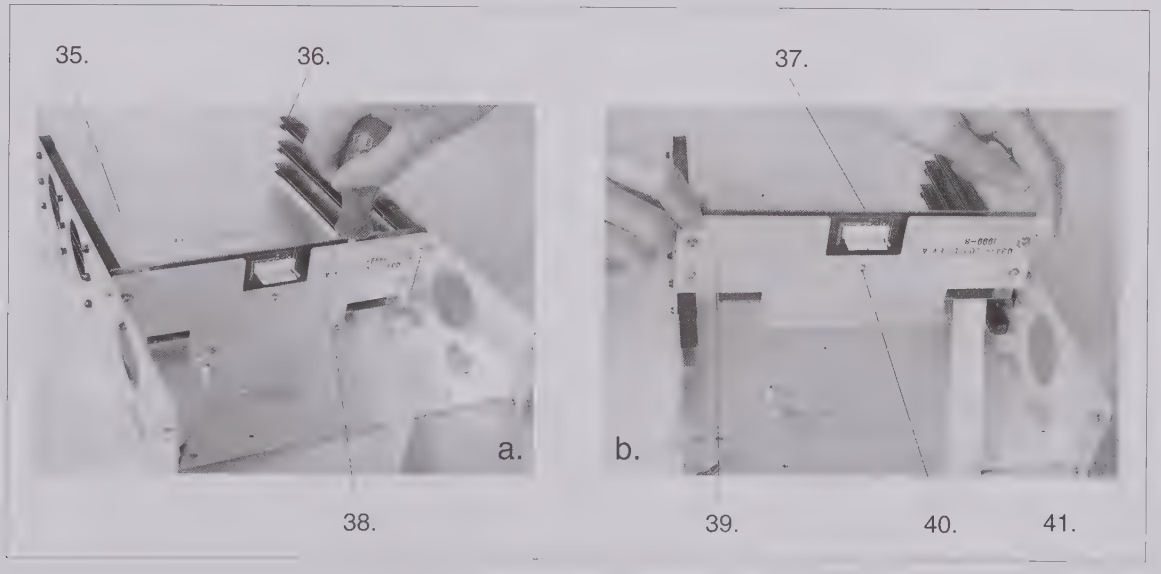


Figure 6-7. Backplane Removal

Assembly Procedures

To assemble an Agilent 3499A/B mainframe, reverse the procedures above.

Agilent 3499A/B Mainframe Replaceable Parts

Table 6-1. Agilent 3499A/B Mainframe Replaceable Parts

ITEM #	Part Number		Qty.	DESCRIPTION
	3499A	3499B		
1	03499-40008	03499-40009	1	WINDOW DISPLAY-FULL/HALF RACK
2	5041-9170		2	TRIM, SIDE
3	03499-40001	03499-40003	1	FRONT PANEL-FULL/HALF RACK
4	5041-0564		1	QUARTER KEY
5	03499-40005		1	KEYPAD
6	34970-87401		1	KNOB
7	0515-0430		2	SCR-MACHINE
8	03499-60001		1	PCA-KEY&VFD CONT UNIT
9	5041-8822		2	FOOT-NON SKID
10	0515-0430		1	SCR-MACHINE
11	5041-8801 1460-1345		2 2	FOOT-MOLD TILT STAND
12	03499-00001	03499-00006	1	COVER-FULL/HALF RACK
13	03499-61007		1	CABLE ASSY LINE
14	03499-61004		1	CBL ASSY-POWER MODULE
15	03499-61002		1	CBL ASSY-GROUND
16			1	Fuse 3.15A, 250 VAC
17	0515-0430		4	SCR-MACHINE
18	0950-2649		1	POWER SUPPLY MODULE
19	03499-40007		1	SAFETY SHIELD POWER SUPPLY
20	03499-61008		1	CONTROL MODULE ASSY
21	5180-8269		2	SCREW M3.0
22	8160-0686		1	RFI STRP-FINGERS
23	0515-0844		4	SCR-MACHINE
24	03499-00008		1	CONTROL CARD-SHIELD COMP
25	03499-00007		1	CONTROL CARD-SHIELD CIRCUIT
26	03499-60004		1	PCA-CONTROL MODULE
27	03499-61009		1	CONTROL PANEL ASSY
28	1400-0249		3	CABLE TIE
29	0515-1934		1	SCR-MACHINE

Table 6-1. Agilent 3499A/B Mainframe Replaceable Parts

ITEM #	Part Number		Qty.	DESCRIPTION
	3499A	3499B		
30	0515-0367		2	SCR-MACHINE
31	0380-0643		2	STDF-HEX .255-IN
32			1	+ 3V Battery
33	1390-0793	0515-0430	2	CAPTIVE SCR/SCR MACHINE
34	03499-40002	03499-40004	1	REAR BEZEL-FULL/HALF RACK
35	03499-00002	03499-00004	1	CHASSIS-FULL/HALF RACK
36	03499-40006		6	PCB CARD GUIDE
37	03499-60003	03499-60002	1	PCA-BACK PLN-FULL/HALF RACK
38	0515-0430		4	SCR-MACHINE
39	03499-00003	03499-00005	1	BACK PLN BRACKET-FULL/HALF RACK
40	0515-0664		5	SCR-MACHINE
41	5041-5209	N/A	1	GUIDE-PC BD
42	3050-1941		1	WSHR-FL NM
43	0535-0154		1	NUT-HEX SGL-CHAM

Plug-in Modules Replaceable Parts

Table 6-2 lists the replaceable parts for the existing Agilent 3499A/B plug-in modules. Kits 1 through Kits 6 are used to refer to the different sets of mechanical kits as described in the follow-up sections.

Table 6-2. Plug-in Modules Replaceable Parts

Product Number	PCA (P/N)	Mechanical Kits	Microwave Module
Agilent 44470A	44470-66511	Kits 1	None
Agilent 44470D	44470-66521		
Agilent 44471A	44471-66511		
Agilent 44471D	44471-66521		
Agilent 44473A	44473-66511		
Agilent 44474A	44474-66501		
Agilent 44477A	44477-66501		
Agilent N2260A	N2260-60001	Kits 2	
Agilent N2261A	N2261-60001		
Agilent N2262A	N2262-60001		
Agilent N2263A	N2263-60001		
Agilent N2264A	N2264-60001		
Agilent N2265A	N2265-60001		
Agilent 44472A	44472-66511	Kits 3	
Agilent 44476A	44476-66501	Kits 4	33311B (x3)
Agilent 44476B		Kits 5	876XX (x2)[a]
Agilent 44478A	44478-66501	Kits 6	None
Agilent 44478B	44478-66502		

a. The microwave modules used with an Agilent 44476B can be the 3-, 4- or 5-port modules (8762A/B/C/F, 8763B/C, 8764B/C), from DC to 26.5 GHz, and must be ordered separately.

Mechanical Kits 1 & 2

Figure 6-8 shows the replaceable mechanical parts for Kits 1 & 2 as listed in Table 6-3.

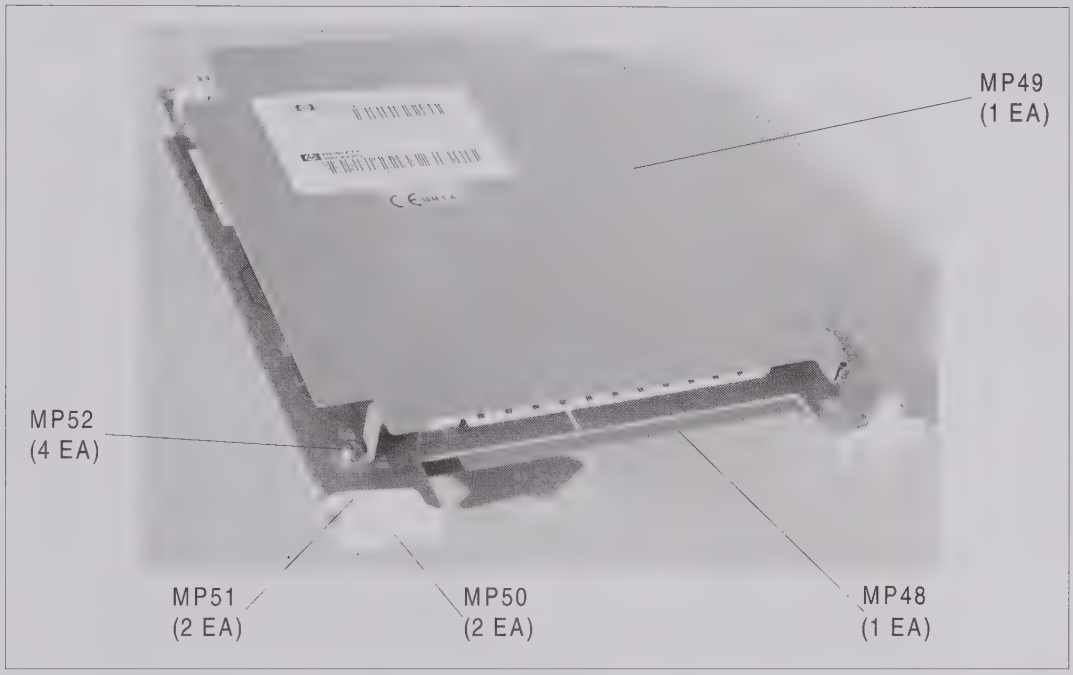


Figure 6-8. Mechanical Kits 1 & 2

Table 6-3. Mechanical Kits 1 & 2

Ref. Designation	Qty.	Description	Kits 1 (P/N)	Kits 2 (P/N)
MP48	1	SHIELD CIRCUIT	03488-00612	5184-0501
MP49	1	SHIELD COMP	03488-00613	5184-0502
MP50	2	PC EXTRACTOR WHT	0403-0464	
MP51	2	PIN-GRV 3/32 X 1/4	1480-0625	
MP52	4	SCREW M3.0 X 06TXSC	0515-0430	

Mechanical Kits 3

Figure 6-9 shows the replaceable mechanical parts (Kits 3) as listed in Table 6-4.

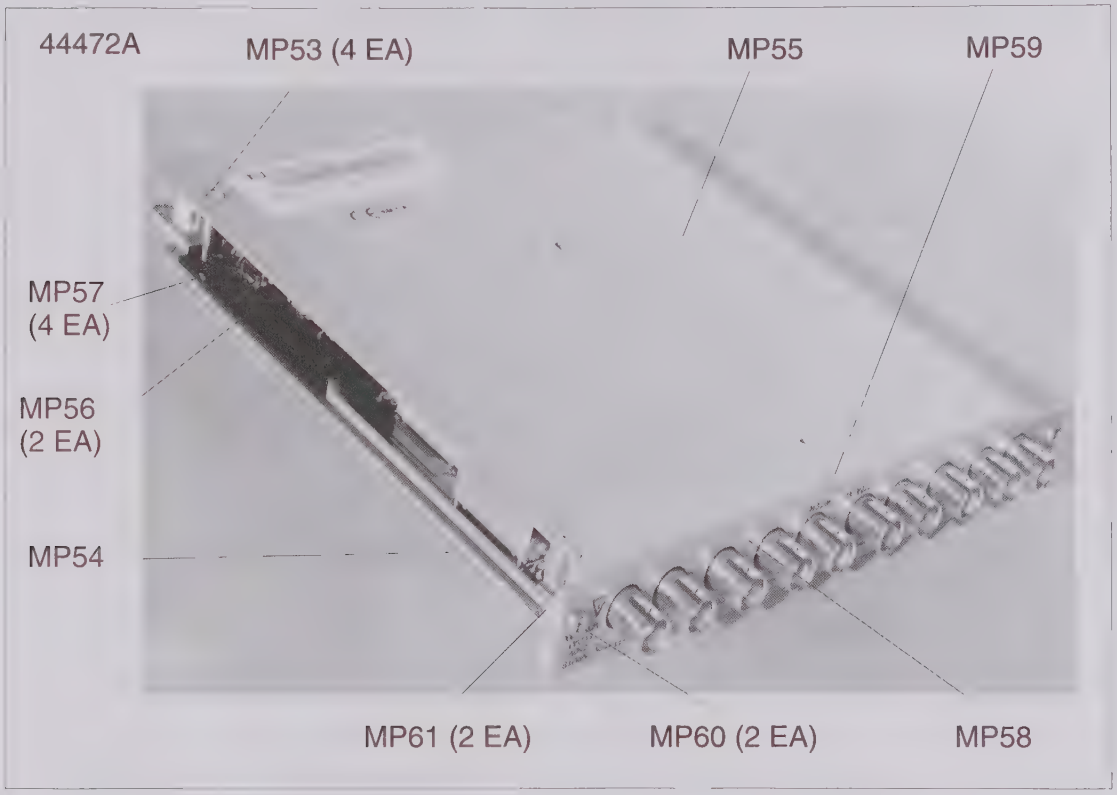


Figure 6-9. Mechanical Kits 3

Table 6-4. Mechanical Kits 3

Ref. Designation	Qty.	Description	Part Number (Kits 3)
MP53	4	SCREW M2.5 X 20 LK	0515-0843
MP54	1	SHIELD-VHF CIRCUIT	44472-00601
MP55	1	SHIELD-VHF COMP	44472-00602
MP56	2	GLIDE PC BOARD	5041-5213
MP57	4	PIN-GRV 3/32 X 1/4	1480-0625
MP58	1	PANEL-REAR VHF	44472-40201
MP59	1	SCREW M2.5 X 8 LK	0515-0403
MP60	2	SCREW, CAPTIVE	5180-8269
MP61	2	RING, RETATINER 3.58	0510-0043

Mechanical Kits 4 & 5

Figure 6-10 shows the replaceable mechanical parts (Kits 4 & 5) as listed in Table 6-5 on page 78.

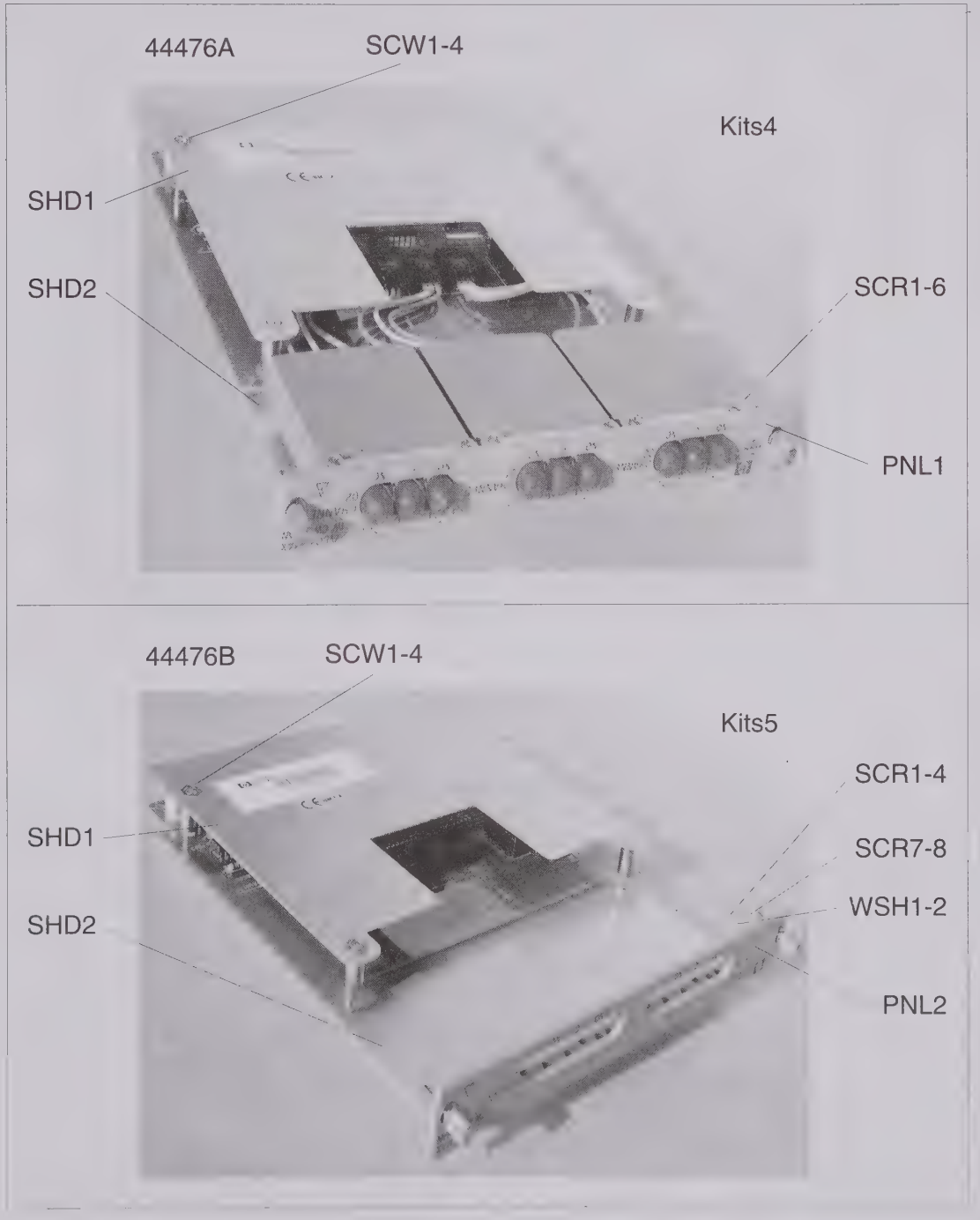


Figure 6-10. Mechanical Kits 4 & 5

Table 6-5. Mechanical Kits 4 & 5

Ref. Designation	Qty.	Description	Part Number	Application
SW1	1	33311B MICORWAVE SW 5V	33311	For 44476A only.
SW2	1			
SW3	1			
SCR1	1	SCREW-PANHEAD M2.5 X 18 LK	0515-1057	For 44476A/B.
SCR2	1			
SCR3	1			
SCR4	1			
SCR5	1			For 44476A only.
SCR6	1			
SCW1	1	SCREW-FLATHEAD M2.5 X 20 LK	0515-0843	For 44476A/B.
SCW2	1			
SCW3	1			
SCW4	1			
SHD1	1	SHIELD - CIRCUIT SIDE	44476-00601	
SHD2	1	SHIELD - COMPONENT SIDE	44476-00602	
PNL1	1	PANEL - Agilent 44476A	44476-00201	For 44476A only.
PNL2	1	PANEL - Agilent 44476B	44476-00202	For 44476B only.
SCR7	1	SCREW-PANHEAD M2.5 X 6mm LONG	0515-0905	
SCR8	1			
WSH1	1	WASHER-LOCK HLCL 2.5 MM 2.6 - MM - ID	2190-2583	
WSH2	1			

Mechanical Kits 6

Figure 6-11 shows the replaceable mechanical parts (Kits 6) as listed in Table 6-6.

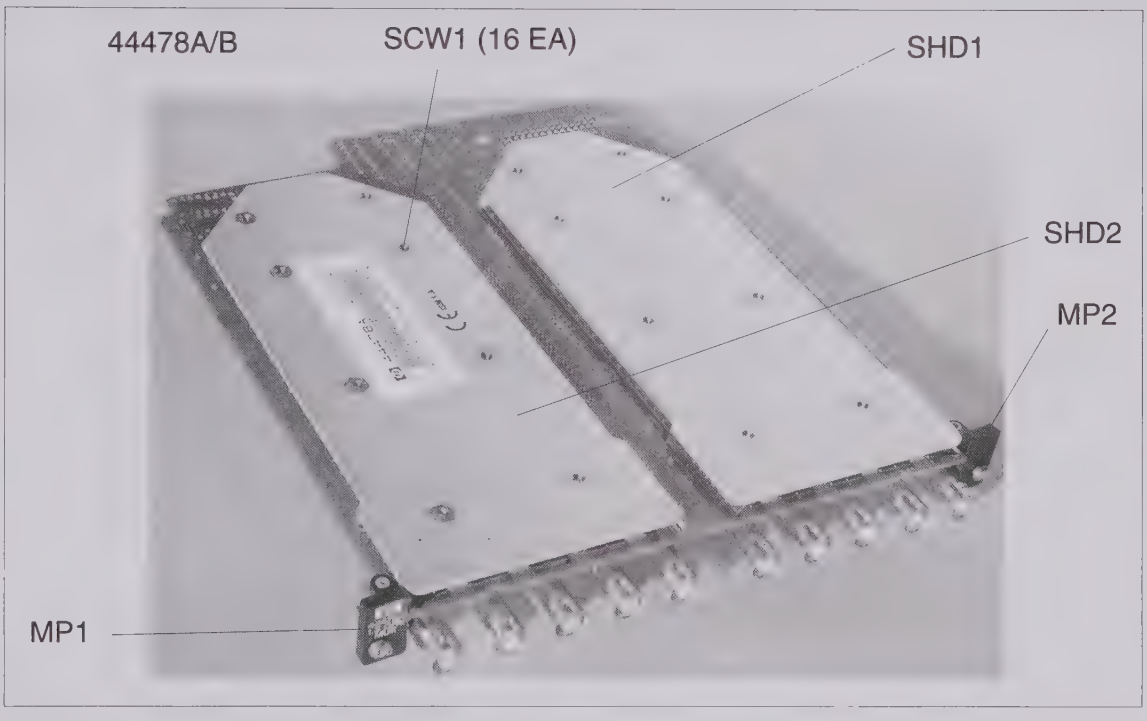


Figure 6-11. Mechanical Kits 6

Table 6-6. Mechanical Kits 6

Ref. Designation	Qty.	Description	Part Number (Kits 6)
MP1	1	BRACKET - LEFT	44478-41201
MP2	1	BRACKET - RIGHT	44478-41203
SCW1-16	16	SCREW-MACH M3.0 X 0.5 6MM-LG PAN-HD	0515-0211
SHD1	1	SHIELD - CIRCUIT SIDE	34505-00601
SHD2	1		

Appendix A
Plug-in Modules Wiring Information

BNC and SMA Connection

The modules listed in Table 6-7 provide BNC or SMA connections to external devices.

Table 6-7. BNC & SMA Connection

Connection Type	Quantity	Module Description
BNC Connector	10	Agilent 44472A Dual 4-Channel VHF Switch Module
	10	Agilent 44478A 50Ω 1.3 GHz MUX Module
	10	Agilent 44478B 75Ω 1.3 GHz MUX Module
SMA Connector	9	Agilent 44476A 3-Channel 18 GHz Switch Module
	6[1]	Agilent 44476B 2-Channel Microwave Switch Module

[1]. The number of SMA connectors depends on the specified microwave modules installed. If the two modules are 5-port, the number of SMA connectors is 10, and so on.

Screw Terminal Blocks

A set of screw terminal blocks are available for wiring conveniences, as listed in Table 6-8. Figure 6-12 through Figure 6-15 illuminate wiring for the three screw terminal block types.

Table 6-8. Screw Terminal Blocks

Screw Terminal Block (Wiring Inf.)	Agilent P/N	Application
Type A[1] (Figure 6-12 on Page 83 & Figure 6-13 on Page 84)	Agilent 44480A	For Agilent 44470A module only (default).
	Agilent 44481A	For Agilent 44471A module only (default).
	Agilent 44483A	For Agilent 44473A module only (default).
	Agilent 44484A	For Agilent 44474A module only (default).
	Agilent 44485A	For Agilent 44475A module only (default).
	Agilent 44487A	For Agilent 44477A module only (default).
Type B (Figure 6-14 on Page 85)	Agilent 44480B	For Agilent 44470D module only (default).
	Agilent 44481B	For Agilent 44471D module only (default).

Table 6-8. Screw Terminal Blocks

Screw Terminal Block (Wiring Inf.)	Agilent P/N	Application
Type C[2] (Figure 6-15 on Page 86)	Agilent N2290A	For Agilent N2260A module only.
	Agilent N2291A	For Agilent N2261A module only.
	Agilent N2292A	For Agilent N2262A module only.
	Agilent N2293A	For Agilent N2263A module only.
	Agilent N2294A	For Agilent N2264A module only.
	Agilent N2295A	For Agilent N2265A module only.

[1]. Types A & B of the screw terminal blocks are provided with the ordered modules.
[2]. Type C of the screw terminal blocks must be ordered separately.

Screw Terminal Block Wiring (Type A)

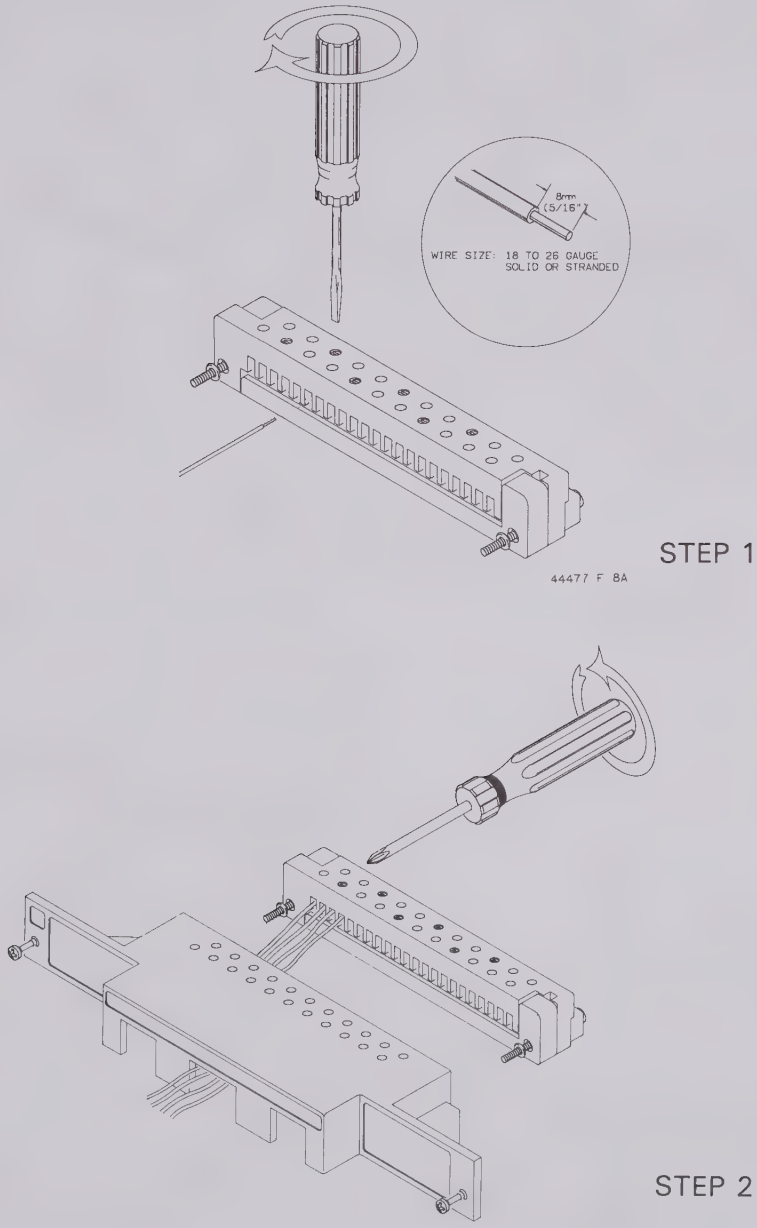


Figure 6-12. Type A Screw Terminal Block Wiring

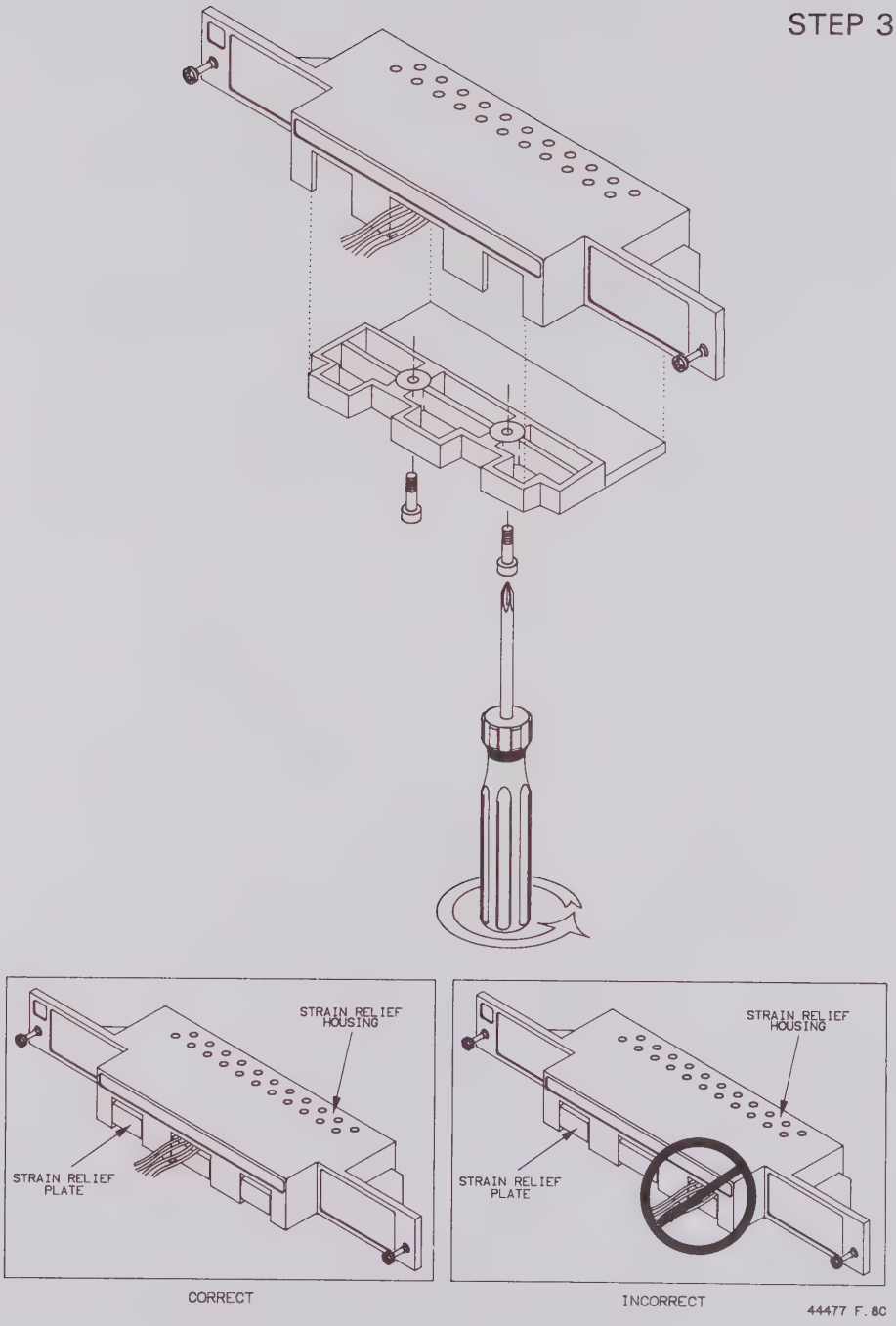


Figure 6-13. Type A Screw Terminal Block Wiring (Cont'd)

Screw Terminal Block Wiring (Type B)

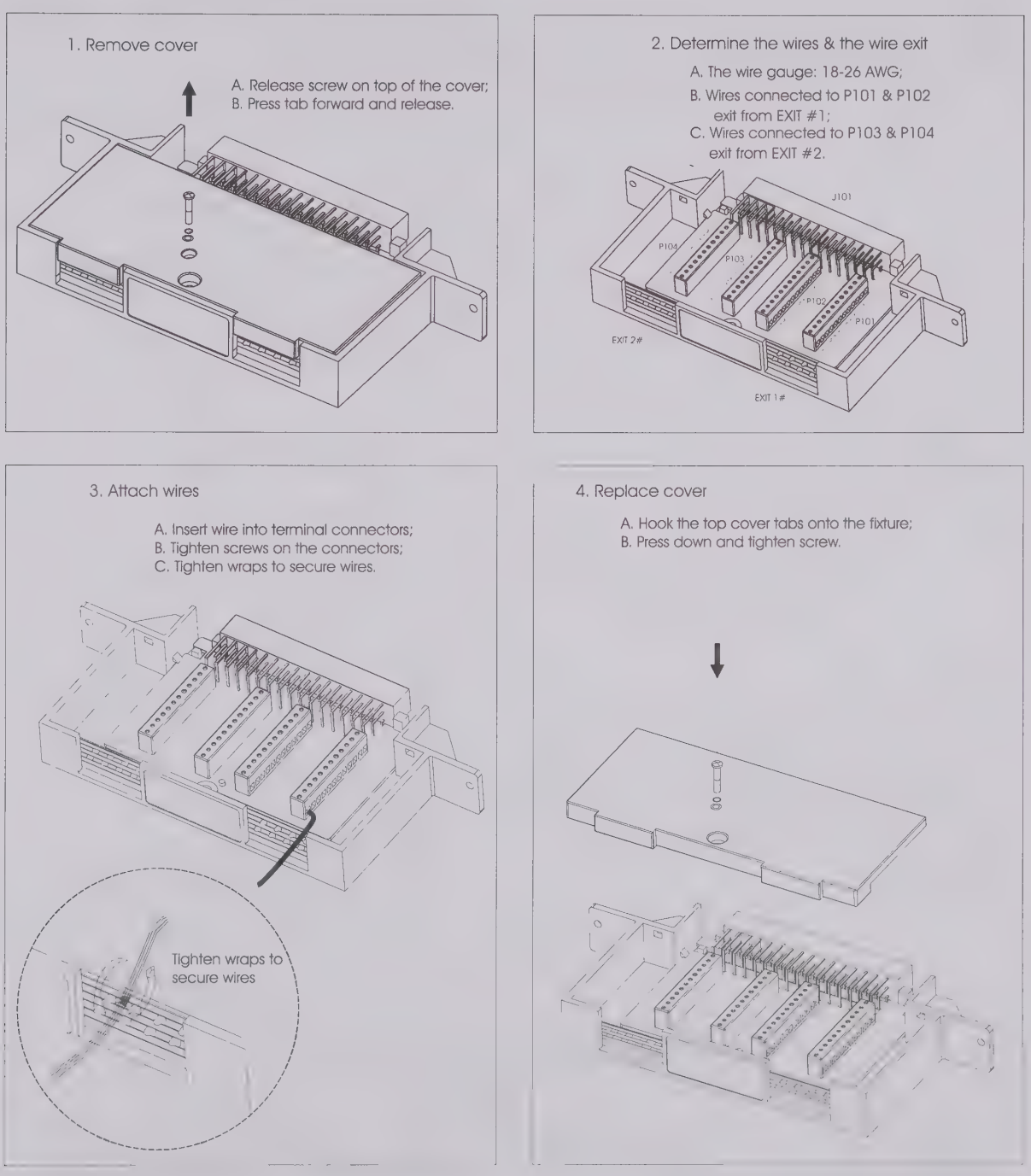
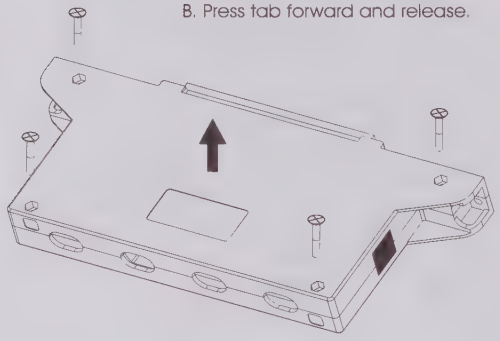

1. Remove cover
A. Release screw on top of the cover;
B. Press tab forward and release.
2. Determine the wires & the wire exit
A. The wire gauge: 18-26 AWG;
B. Wires connected to P101 & P102 exit from EXIT #1;
C. Wires connected to P103 & P104 exit from EXIT #2.
J101
P104
P103
P102
P101
EXIT 2#
EXIT 1#
3. Attach wires
A. Insert wire into terminal connectors;
B. Tighten screws on the connectors;
C. Tighten wraps to secure wires.
Tighten wraps to secure wires
4. Replace cover
A. Hook the top cover tabs onto the fixture;
B. Press down and tighten screw.

Figure 6-14. Type B Screw Terminal Block Wiring

Screw Terminal Block Wiring (Type C)

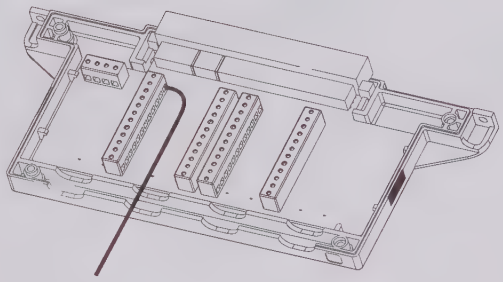
STEP 1. Remove cover

A. Release screws on top of the cover;
B. Press tab forward and release.



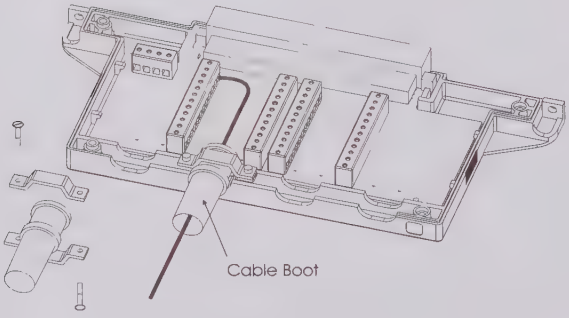
STEP 2. Attach wires

A. The wire gauge: 18-26 AWG;
B. Insert wire into terminal connectors;
C. Tighten screws on the connectors.



STEP 3. Tighten the wires

A. Insert the wires into the nearest cable boot, move the cable boot to the Cable slot;
B. Tighten the cable boot.



STEP 4. Replace cover

A. Hook the top cover tabs onto the fixture;
B. Press down and tighten screws.

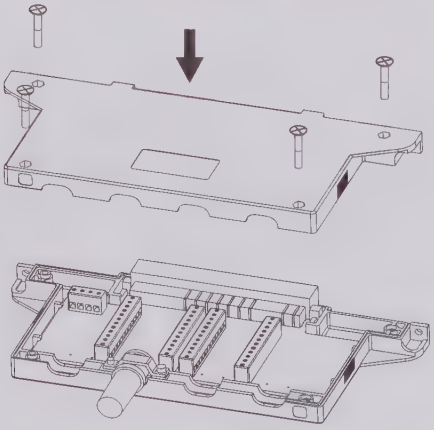


Figure 6-15. Type C Screw Terminal Block Wiring

Crimp-and-insert Terminal Block

Agilent N2296A is a crimp-and-insert terminal block for Agilent N2260A, N2261A, N2262A, N2263A, N2264A and N2265A. It provides a flexibility for connecting the above modules to external devices. The wiring procedure for the Agilent N2296A is shown in Figure 6-16.

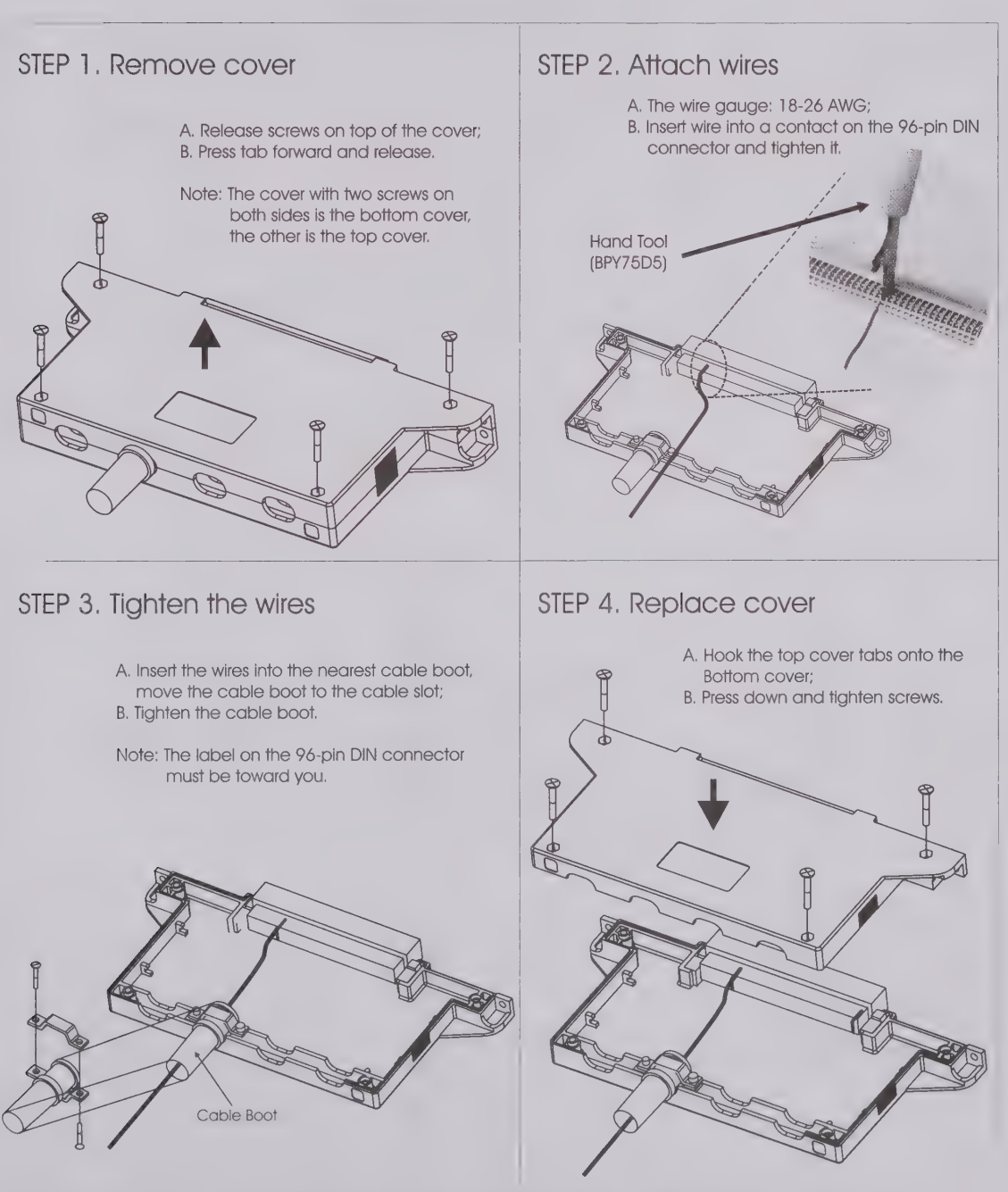

STEP 1. Remove cover
A. Release screws on top of the cover;
B. Press tab forward and release.
Note: The cover with two screws on both sides is the bottom cover, the other is the top cover.
STEP 2. Attach wires
A. The wire gauge: 18-26 AWG;
B. Insert wire into a contact on the 96-pin DIN connector and tighten it.
Hand Tool (BPY75D5)
STEP 3. Tighten the wires
A. Insert the wires into the nearest cable boot, move the cable boot to the cable slot;
B. Tighten the cable boot.
Note: The label on the 96-pin DIN connector must be toward you.
Cable Boot
STEP 4. Replace cover
A. Hook the top cover tabs onto the Bottom cover;
B. Press down and tighten screws.

Figure 6-16. Crimp-and-Insert Terminal Block Wiring

DIN-TO-D Cables

Three DIN-to-D cables are available for the Agilent N22XX series modules. The 96-pin female DIN connectors at one end of the cables are used to connect the plug-in modules, and the other ends are either 50-pin or 25-pin female sub-D connectors, as listed in Table 6-9.

Table 6-9. DIN-TO-D Cables

Agilent P/N	Description	Application
Agilent N2297A	**DIN96-TO-TWIN-D50 CABLE:** 1.5-meter round cable terminated with a 96-pin female DIN connector at one end, two 50-pin male sub-D connectors at another end	For Agilent N2260A/61A/62A/63A/64A/65A.
Agilent N2298A	**DIN96-TO-D25 CABLE:** 1.5-meter round cable terminated with a 96-pin female DIN connector at one end, a 25-pin male sub-D connector at another end.	For Agilent N2262A only.
Agilent N2299A	**DIN96-TO-QUAD-D25 CABLE:** 1.5-meter round cable terminated with a 96-pin female DIN connector at one end, four 25-pin male sub-D connectors at another end	For Agilent N2260A/61A/62A/63A/64A/65A.

Agilent N2297A

Figure 6-17 shows an Agilent N2297A. The wire gauge is 26 AWG (which meets UL AWM: 2464), the maximum voltage is 200 volts per wire. The connection between the 96-pin female DIN connector and the two 50-pin sub-D male connectors is also listed.

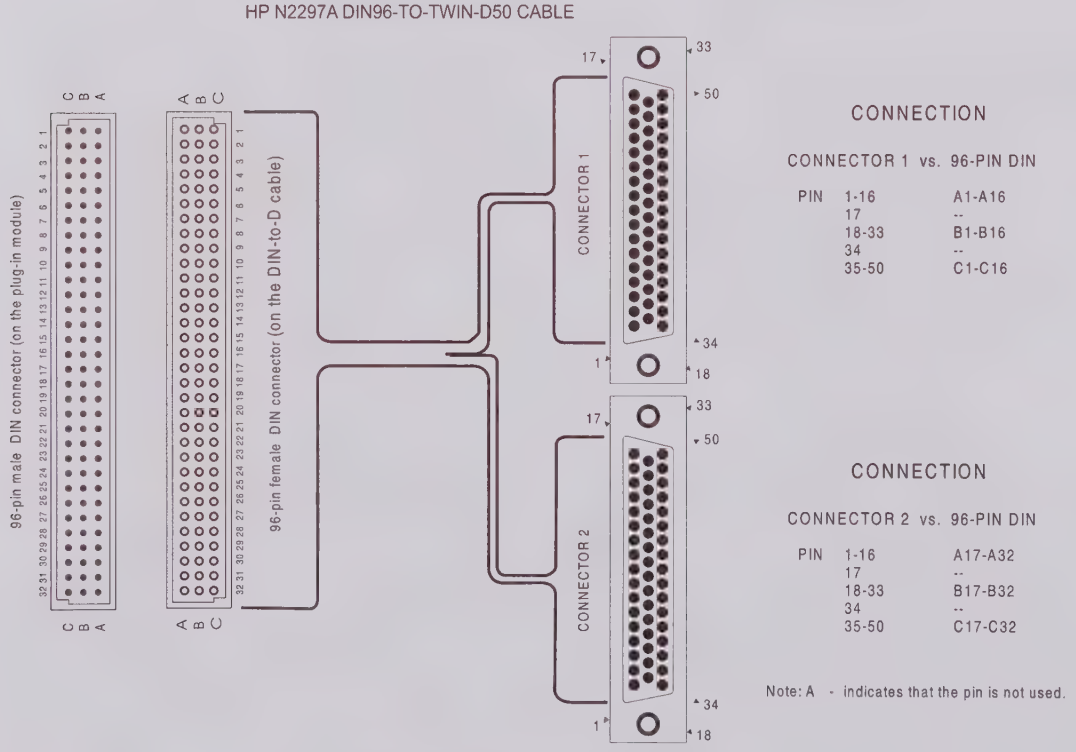


Figure 6-17. Agilent N2297A Cable

Agilent N2298A

Figure 6-17 shows an Agilent N2298A. The wire gauge is 24 AWG (which meets UL AWM: 2464), the maximum voltage is 200 volts per wire. The connection between the 96-pin female DIN connector and the 25-pin sub-D male connector is also listed.

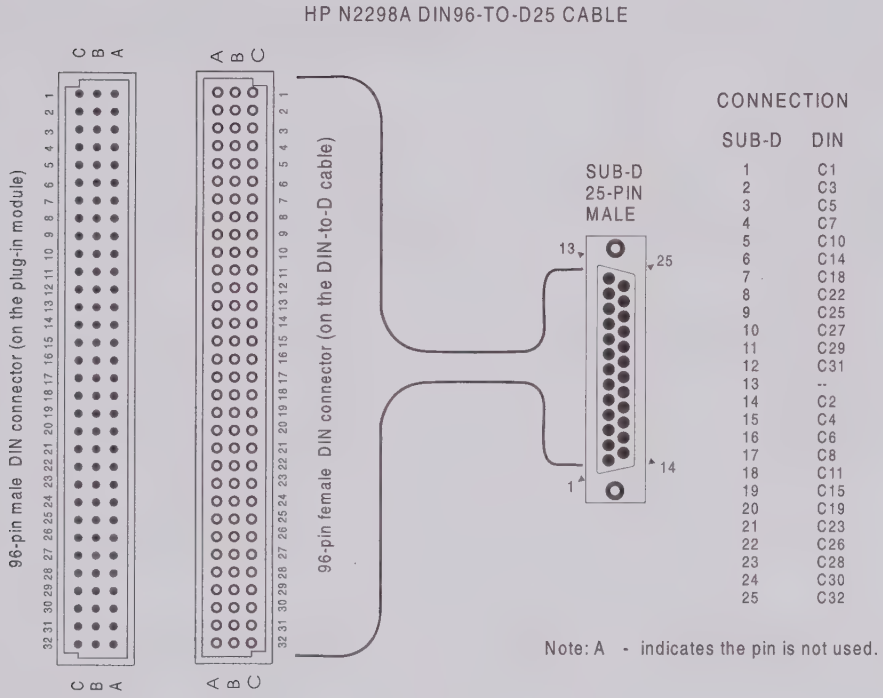
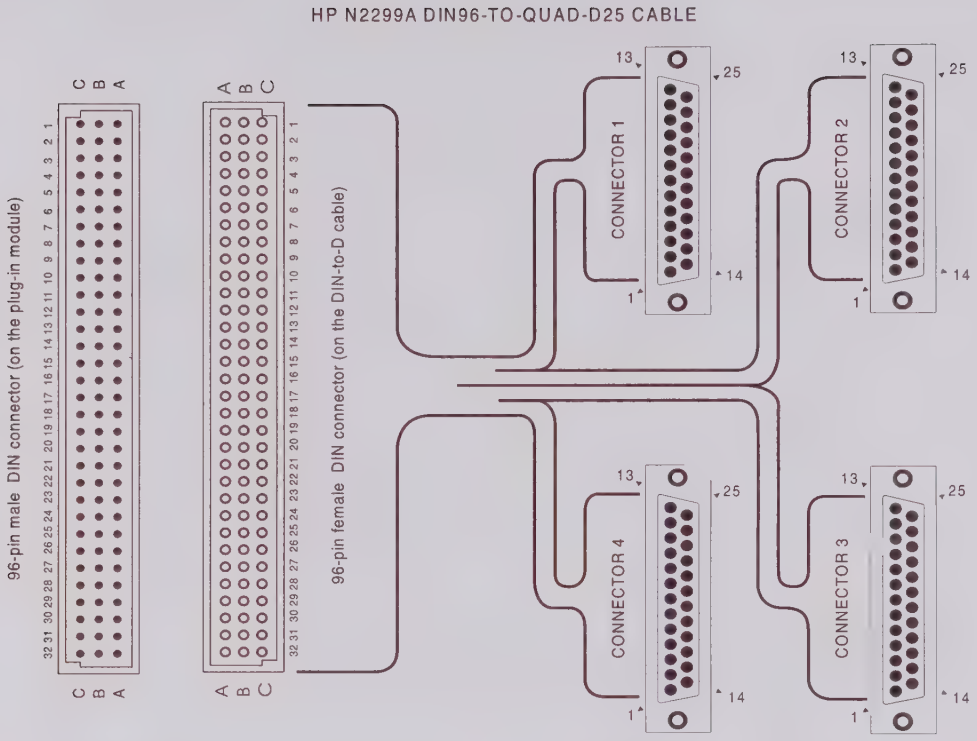


Figure 6-18. Agilent N2298A Cable

Agilent N2299A

Figure 6-19 on Page 90 shows an Agilent N2299A. The wire gauge is 24 AWG (which meets UL AWM: 2464), the maximum voltage is 200 volts per wire. The connection between the 96-pin female DIN connector and the four 25-pin sub-D male connectors is also listed.



CONNECTOR 1 vs. 96-PIN DIN

SUB-D	DIN
1	A1
2	B1
3	C1
4	A3
5	B3
6	C3
7	A5
8	B5
9	C5
10	A7
11	B7
12	C7
13	--
14	A2
15	B2
16	C2
17	A4
18	B4
19	C4
20	A6
21	B6
22	C6
23	A8
24	B8
25	C8

CONNECTOR 2 vs. 96-PIN DIN

SUB-D	DIN
1	A9
2	B9
3	C9
4	A11
5	B11
6	C11
7	A13
8	B13
9	C13
10	A15
11	B15
12	C15
13	--
14	A10
15	B10
16	C10
17	A12
18	B12
19	C12
20	A14
21	B14
22	C14
23	A16
24	B16
25	C16

CONNECTOR 3 vs. 96-PIN DIN

SUB-D	DIN
1	A17
2	B17
3	C17
4	A19
5	B19
6	C19
7	A21
8	B21
9	C21
10	A23
11	B23
12	C23
13	--
14	A18
15	B18
16	C18
17	A20
18	B20
19	C20
20	A22
21	B22
22	C22
23	A24
24	B24
25	C24

CONNECTOR 4 vs. 96-PIN DIN

SUB-D	DIN
1	A25
2	B25
3	C25
4	A27
5	B27
6	C27
7	A29
8	B29
9	C29
10	A31
11	B31
12	C31
13	--
14	A26
15	B26
16	C26
17	A28
18	B28
19	C28
20	A30
21	B30
22	C30
23	A32
24	B32
25	C32

Note: A - indicates the pin is not used.

Figure 6-19. Agilent N2299A Cable

Appendix B
Error Messages

Agilent 3499A/B Switch/Control System can be operated in either SCPI mode or HP 3488A mode. The error messages are different in different system modes. This Appendix lists all these error messages.

In SCPI mode

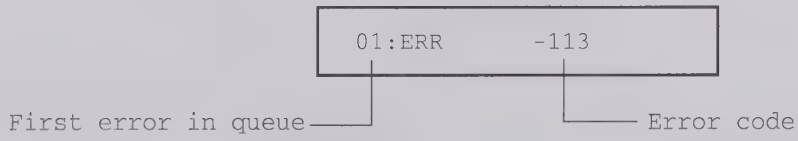
- Errors are retrieved in first-in-first-out (FIFO) order. The first error returned is the first error that was stored. Errors are cleared as you read them. When you have read all errors from the queue, the ERROR annunciator turns off and the errors are cleared. The instrument beeps once each time an error is generated.

- If more than 10 errors have occurred, the last error stored in the queue (the most recent error) is replaced with -350, "Queue overflow". No additional errors are stored until you remove errors from the queue. If no errors have occurred when you read the error queue, the instrument responds with +0, "No error".

- The error queue is cleared by the *CLS (clear status) command or when power is cycled. The errors are also cleared when you read the queue. The error queue is not cleared by an instrument reset (*RST command) or a card/module reset (SYSTem:CPON command).

- ***Front-Panel Operation:***

  If the ERROR annunciator is on, press **View** to view the errors stored in the queue. Use the knob to scroll through the error numbers. Press the arrow key (right) to view the text of the error message. All errors are cleared when you exit the menu.



- ***Remote Interface Operation:***

  SYSTem:ERRor? Read and clear one error from the error queue

  Errors have the following format (the error string may contain up to 80 characters):

  -113, "Undefined header".

-101 **Invalid character**

An invalid character was found in the command string. You may have used an invalid character such as #, {, $, or % in the command header or within a parameter.
Example: *OPEN {@101)*

-102 **Syntax error**

Invalid syntax was found in the command string. You may have inserted a blank space before or after a colon in the command header, or before a comma. Or you may have omitted the "@" character in the channel list syntax.
Examples: *ROUT:CHAN: DEL 1 or ROUT:OPEN (101:102)*

-103 **Invalid separator**

An invalid separator was found in the command string. You may have used a comma instead of a colon, semicolon, or blank space -- or you may have used a blank space instead of a comma.
Example: *TRIG:COUNT,1*

-105 **GET not allowed**

A Group Execute Trigger (GET) is not allowed within a command string.

-108 **Parameter not allowed**

More parameters were received than expected for this command. You may have entered an extra parameter or added a parameter to a command that does not require a parameter.
Example: *ROUT:CLOS:STAT? 2*

-109 **Missing parameter**

Fewer parameters were received than were expected for this command. You have omitted one or more parameters that are required for this command.
Example: *ROUT:CHAN:DEL 10,*

-112 **Program mnemonic too long**

A command header was received which contained more than the maximum 12 characters allowed.
Example: *CONFIGURE:EXTERNAL:TRIGGER:SOURCE 2*

-113 **Undefined header**

A command was received that is not valid for this instrument. You may have misspelled the command or it may not be a valid command. If you are using the short form of this command, remember that it may contain up to four letters.
Examples: *TRIGG:SOUR TIM*

-121 **Invalid character in number**

An invalid character was found in the number specified for a parameter.
Example: *TRIG:TIMER 12..34*

-123 **Exponent too large**

A numeric parameter was found whose exponent was large than 32,000.

-124 **Too many digits**

A numeric parameter was found whose mantissa contained more than 255 digits, excluding leading zeros.

-128 **Numeric data not allowed**

The wrong parameter type was found in the command string. You may have specified a number where a string or expression was expected, or vice versa.
Examples: *DISP:TEXT 5.0 or ROUT:CLOSE 101*

-131 **Invalid suffix**

A suffix was incorrectly specified for a numeric parameter. You may have misspelled the suffix.

-134 **Suffix too long**

A header suffix is the number that can be appended to the end of some command headers. This error is generated if the header suffix contains more than 12 characters.

-138 **Suffix not allowed**

A suffix was received following a numeric parameter. You may have misspelled the suffix.

-148 **Character data not allowed**

A discrete parameter was received but a character string or a numeric parameter was expected. Check the list of parameters to verify that you have used a valid parameter type.
Examples: *ROUTE:CLOSE CH101 or DIAG:DISP TEXT123 (the string must be enclosed in quotes)*

-151 **Invalid string data**

An invalid character string was received. Check to see if you have enclosed the character string in quotation marks and verify that the string contains valid ASCII characters.
Example: *DIAG:DISP 'TESTING (the ending quote is missing)*

-158 **String data not allowed**

A character string was received but is not allowed for this command. Check the list of parameters to verify that you have used a valid parameter type.

-161 **Invalid block data**

For a definite-length block, the number of types of data sent does not match the number of bytes that you specified in the block header

-168 **Block data not allowed**

Data was sent to the instrument in SCPI definite length block format but this command does not accept this format.

-178 **Expression data not allowed**

A channel list was received but is not allowed for this command.
Example: *SYST:CTYPE? (@100)*

-222 **Data out of range**

A numeric parameter value is outside the valid range for this command.
Example: *ARM:COUNT -3*

-223 **Too much data**

A character string was received but could not be executed because the string length was more than 12 characters. This error can be generated by the DIAGnostic:DISPlay command.

-224 **Illegal parameter value**

A discrete parameter was received which was not a valid choice for this command. You may have used an invalid parameter choice.
Example: *TRIG:SOURCE ALARM (ALARM is not a valid choice)*

-310 **System error**

A firmware defect has been found. This is not a fatal error but you should contact your nearest Hewlett-Packard Service Center if this error is reported.

-350 **Queue overflow**

The error queue is full because more than 10 errors have occurred. No additional errors are stored until you remove errors from the queue. The error queue is cleared by the *CLS

(clear status) command or when power is cycled. The errors are also cleared when you read the queue.

-410 **Query INTERRUPTED**

A command was received which sends data to the output buffer, but the output buffer contained data from a previous command (the previous data is not overwritten). The output buffer is cleared when power has been off or after a bus Device Clear.

-420 **Query UNTERMINATED**

The instrument was addressed to talk (i.e., send data over the interface) but a command has not been received which sends data to the output buffer. For example, you may have executed a CONFigure command (which does not generate data) and then attempted to read data from the remote interface.

-430 **Query DEADLOCKED**

A command was received which generates too much data to fit in the output buffer and the input buffer is also full. Command execution continues but all data is lost.

-440 **Query UNTERMINATED after indefinite response**

The *IDN? command must be the last query command within a command string. The *IDN? command returns an indefinite length string which cannot be combined with any other query command.
Example: **IDN?;*STB?*

Instrument Errors

100 **Number of SAV/RCL out of range**

Up to 10 channel setups (1-10) can be stored and recalled. This error will occur if a number included in *SAV/*RCL is not between 1 and 10.
Examples: **SAV 12 or *RCL 0*

101 **Unable to recall - scan is running**

102 **Unable to recall - memory is empty**

103 **Unable to recall - modules were changed**

Before recalling a stored channel setup, the instrument verifies the same module types are installed in each slot. This error indicates that the instrument has detected one or multiple modules in the specific slots have been replaced with other types or removed from the instrument.

104 **Unable to store - scan is running**

110 **Slot number out of range**

The specified slot number is invalid. The channel number has the form (@snn), where s is the slot number and nn is the channel number.
Example: *OPEN (@604)*

111 **Data out of range**

The data for some commands is invalid.
Example: *SOUR:DIG:DATA:BYTE:VAL 266 (valid data should be 0-255)*

112 **Not able to perform requested operation**

The requested operation is not valid for the instrument.
Example: *FUNC 3,BIWIRE2 (the module in Slot 3 is not an Agilent N2260A).*

113 **Block name not exist**

In an Agilent 3499A/B, maximum two blocks can be defined. The two defined blocks can

be read and written, etc. If you read or write a block that has not been previously defined, this error occurs.

114 **Block name already exist**

The instrument has detected a defined block name, while you are to define it once more.

115 **Two Blocks already exist**

The instrument has detected two defined block names while you are to define them once more.

116 **Channel number out of range**

The specified channel number is invalid for the module in the selected slot. The channel number has the form (@snn), where s is the slot number and nn is the channel number.

Example: ROUT:CLOSE (@156)

201 **Scan list is empty**

202 **Scan initiated**

203 **Scan init ignored**

204 **Trig ignored**

205 **Hardware trigger too fast**

206 **Too many channels**

207 **Card in use.**

300 **Unable to execute this command in local mode**

501 **RS232 data receiving error**

502 **Internal command error**

503 **RS232 only - unable to execute on GPIB**

There are three commands which are allowd only with the RS-232 interface: SYSTem:LOCal, SYSTem:REMote, SYSTem:RWLock.

Self-Test Errors

The errors listed in Table 6-10 indicate failures that may occur during a self-test (in SCPI mode).

Table 6-10. Self -Test Errors

Error Number	Description
+1	ROM test failed.
+2	GPIB test failed.
+3	RS-232 test failed.
+4	Front-panel test failed.

Note A string "+0" read back (with command *TST) indicates that all the tests have passed. In this case, a string "PASSED" displays on the front panel of the instrument.

In HP 3488A Mode

Error Conditions

In HP 3488A mode, you can also query the error queue when the ERROR annuciator is on. The returned decimal value is equal to the sum of the values of the possible error conditions, as defined in Table 6-11.

Table 6-11. Error Conditions in HP 3488A Mode

Weighted Value	Error Condition
1	Syntax Error
2	Execution Error which include: a. Parameter out of range; b. Module type mismatch; c. Attempt to access a nonexistent stored state or scan list.
4	Hardware Trigger too fast
8	Logical Failure
16	Power Supply Failure

Note A string "+00000" read back (with the command ERROR) indicates that the error queue is empty. In this case, a string "0000" displays on the front panel of the instrument.

Self Test Errors

The errors listed in Table 6-12 indicate failures that may occur during a self-test (in HP 3488A mode).

Table 6-12. Self -Test Errors

Error Number	Description
+1	ROM test failed.
+2	GPIB test failed.
+3	RS-232 test failed.
+4	Front-panel test failed.

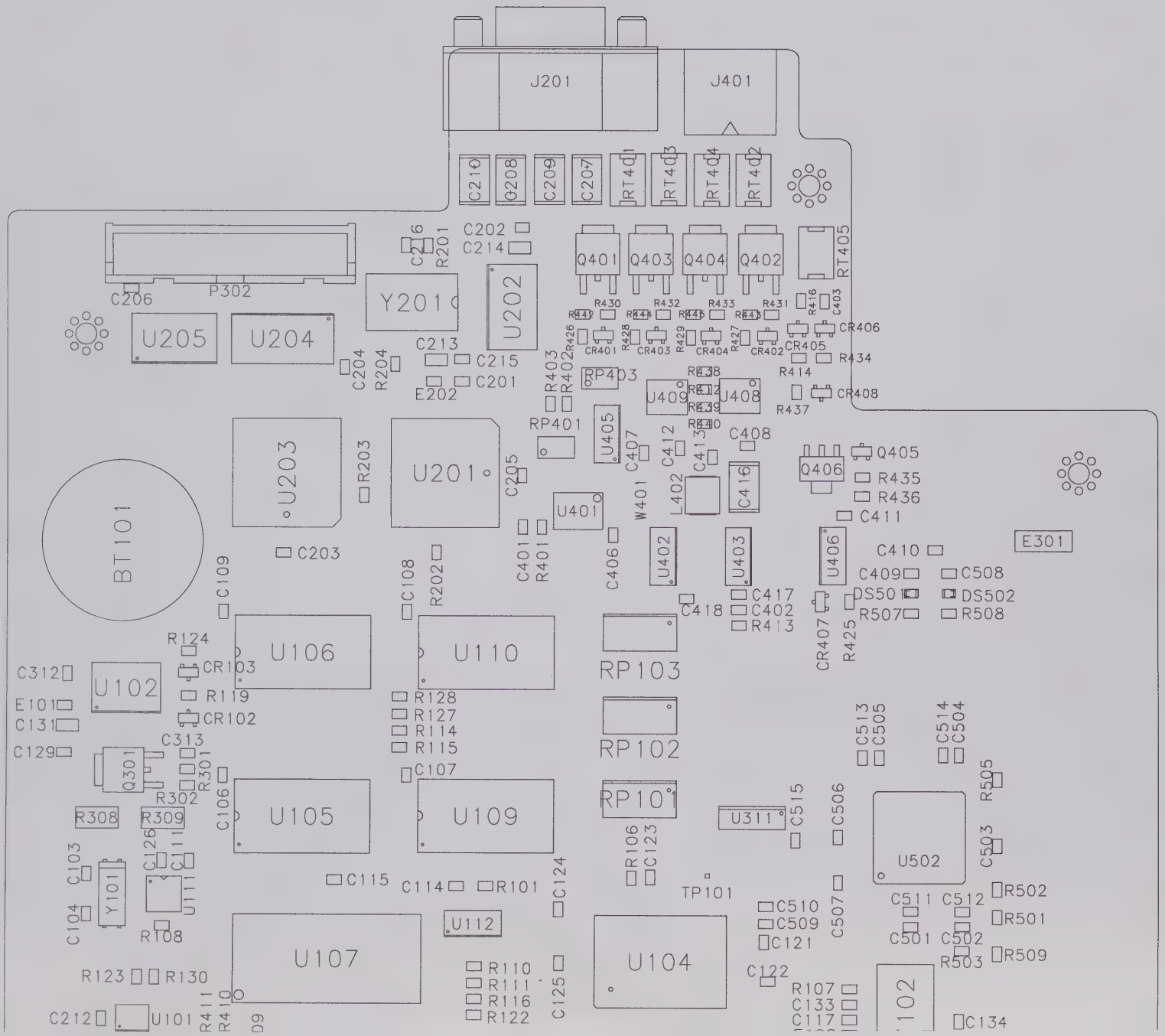
Note A string "+0" read back (with the command TEST) indicates that all the tests have passed. In this case, a string "PASSED" displays on the front panel of the instrument.

Appendix C
Schematics

This chapter contains the schematics for the Agilent 3499A/B mainframes and the plug-in modules designed for Agilent 3499A/B Switch/Control System. For the schematics of the existing Agilent 3488A plug-in modules, you can refer to the *HP 3488A Switch/Control System Service Manual.*

The schematics in this chapter include:

- Agilent 3499A/B Controller PC Board Components Locator ..... Page 99
- Agilent 3499A/B Controller PC Board Schematics ..... Page 100
- Agilent 3499A/B Keyboard & Display Components Locator & Schematics ..... Page 105
- Agilent 3499A/B Backplane Components Locator & Schematics..... Page 108
- Agilent N2260A Components Locator..... Page 110
- Agilent N2260A Schematics ..... Page 111
- Agilent N2290A Components Location & Schematics ..... Page 115
- Agilent N2261A Components Locator..... Page 116
- Agilent N2261A Schematics ..... Page 117
- Agilent N2291A Components Location & Schematics ..... Page 121
- Agilent N2262A Components Locator..... Page 122
- Agilent N2262A Schematics ..... Page 123
- Agilent N2292A Components Location & Schematics ..... Page 126
- Agilent N2263A Components Locator..... Page 127
- Agilent N2263A Schematics ..... Page 128
- Agilent N2293A Components Location & Schematics ..... Page 135
- Agilent N2264A Components Locator..... Page 136
- Agilent N2264A Schematics ..... Page 137
- Agilent N2294A Components Location & Schematics ..... Page 143
- Agilent N2265A Components Locator..... Page 144
- Agilent N2265A Schematics ..... Page 145
- Agilent N2295A Components Location & Schematics ..... Page 151
- Agilent 44470D Components Locator ..... Page 152
- Agilent 44470D Schematics..... Page 153
- Agilent 44480B Components Location & Schematics..... Page 157
- Agilent 44471D Components Locator ..... Page 158
- Agilent 44471D Schematics..... Page 159
- Agilent 44481B Components Location & Schematics..... Page 163


J201
J401
C210
C208
C209
C207
RT401
RT403
RT404
RT402
C206
P302
C216
R201
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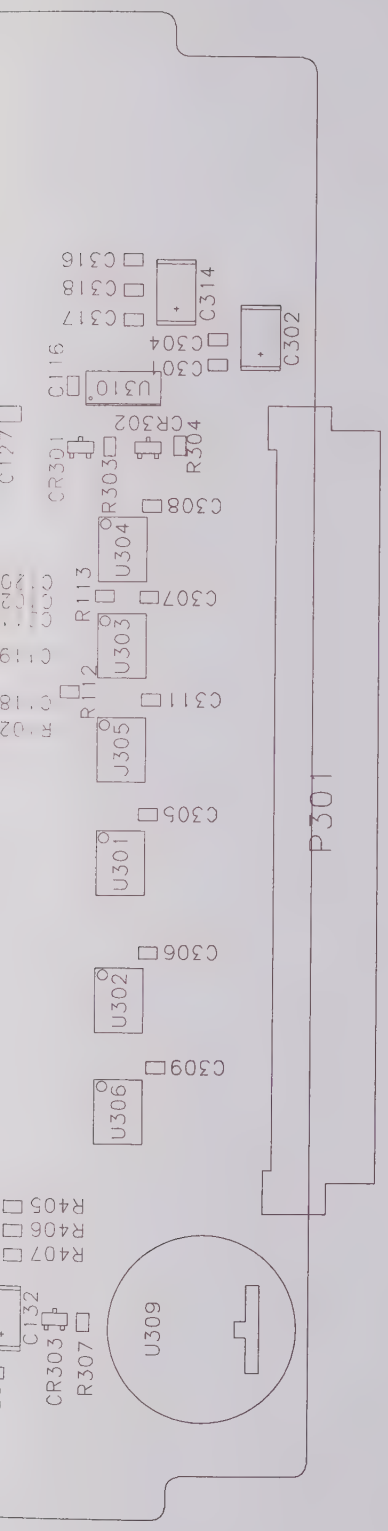
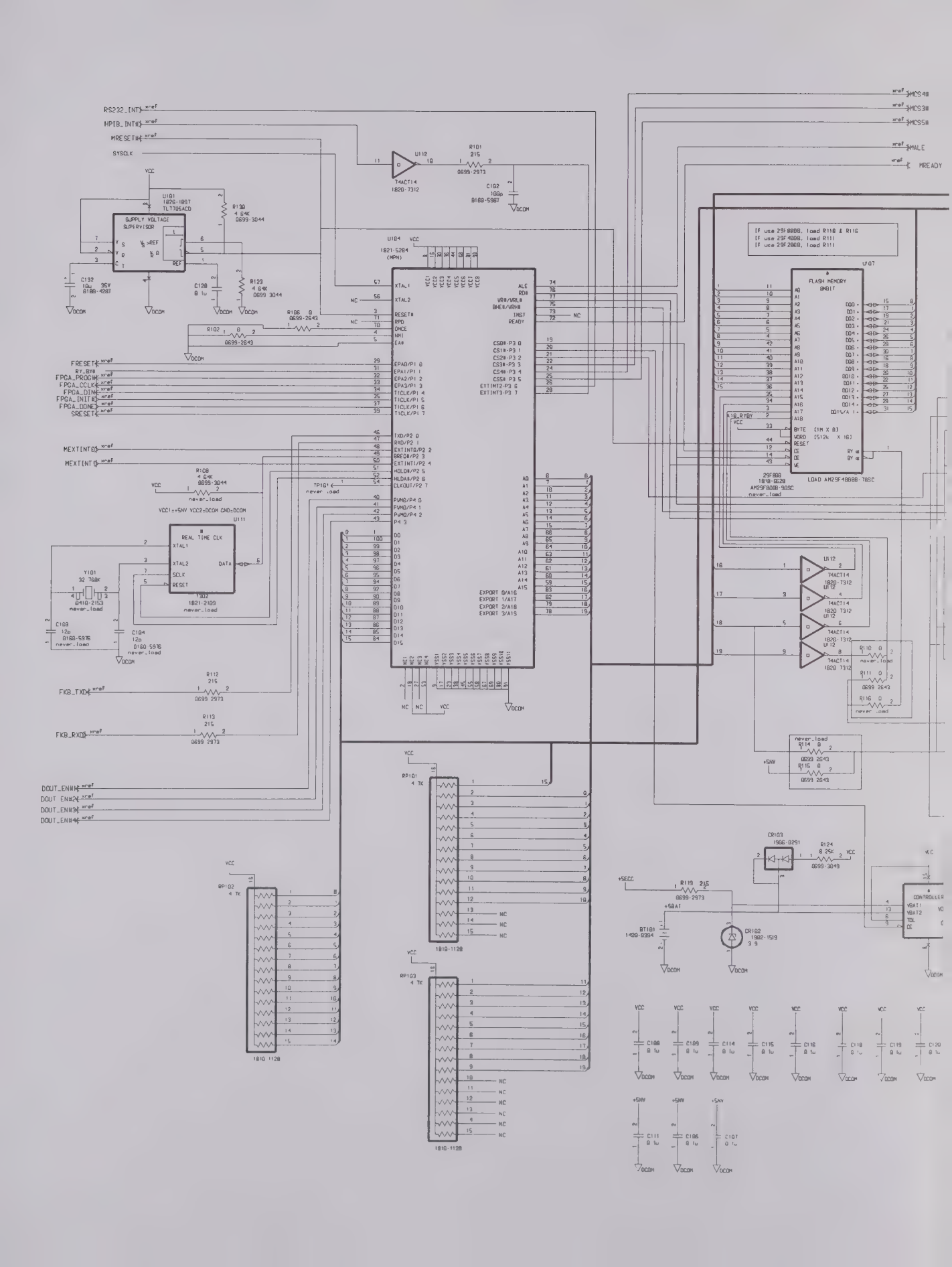
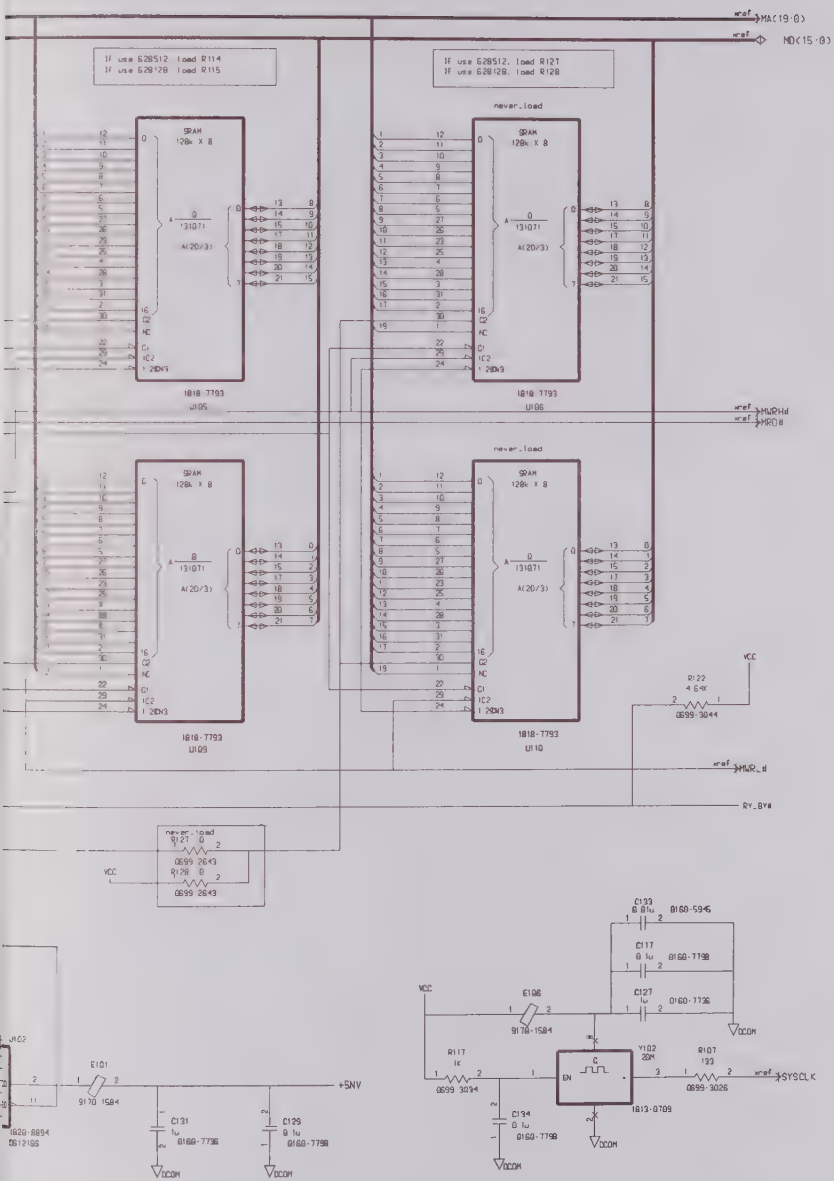
C214
Y201
U202
Q401
Q403
Q404
Q402
RT405
R430
R432
R433
R431
R416
C403
CR406
U205
U204
R426
CR401
R428
CR403
R429
CR404
R427
CR402
CR405
R434
C213
C215
C204
R204
E202
C201
R403
R402
RP403
R438
R414
U409
U408
CR408
R437
U203
U201
RP401
U405
C407
C412
C413
C408
Q406
Q405
R435
R436
C411
BT101
C205
W401
L402
C416
C203
U401
C410
E301
C109
C108
R202
C401
R401
C406
U402
U403
U406
C409
C508
DS501
DS502
C417
C418
C402
R413
R507
R508
CR407
R425
R124
U106
U110
RP103
C312
U102
CR103
E101
R119
C131
CR102
R128
R127
R114
R115
RP102
C513
C505
C514
C504
C129
C313
Q301
R301
C107
R302
C106
U105
U109
RP101
U311
C515
C506
R505
R308
R309
C126
C111
U502
C503
C103
Y101
C115
C114
R101
C124
R106
C123
TP101
C510
C509
C121
C507
C511
C512
R502
R501
C104
U111
R108
U112
C501
C502
R503
R509
R123
R130
U107
U104
R110
R111
R116
R122
C125
C122
R107
C133
C117
C212
U101
R411
R410
C134

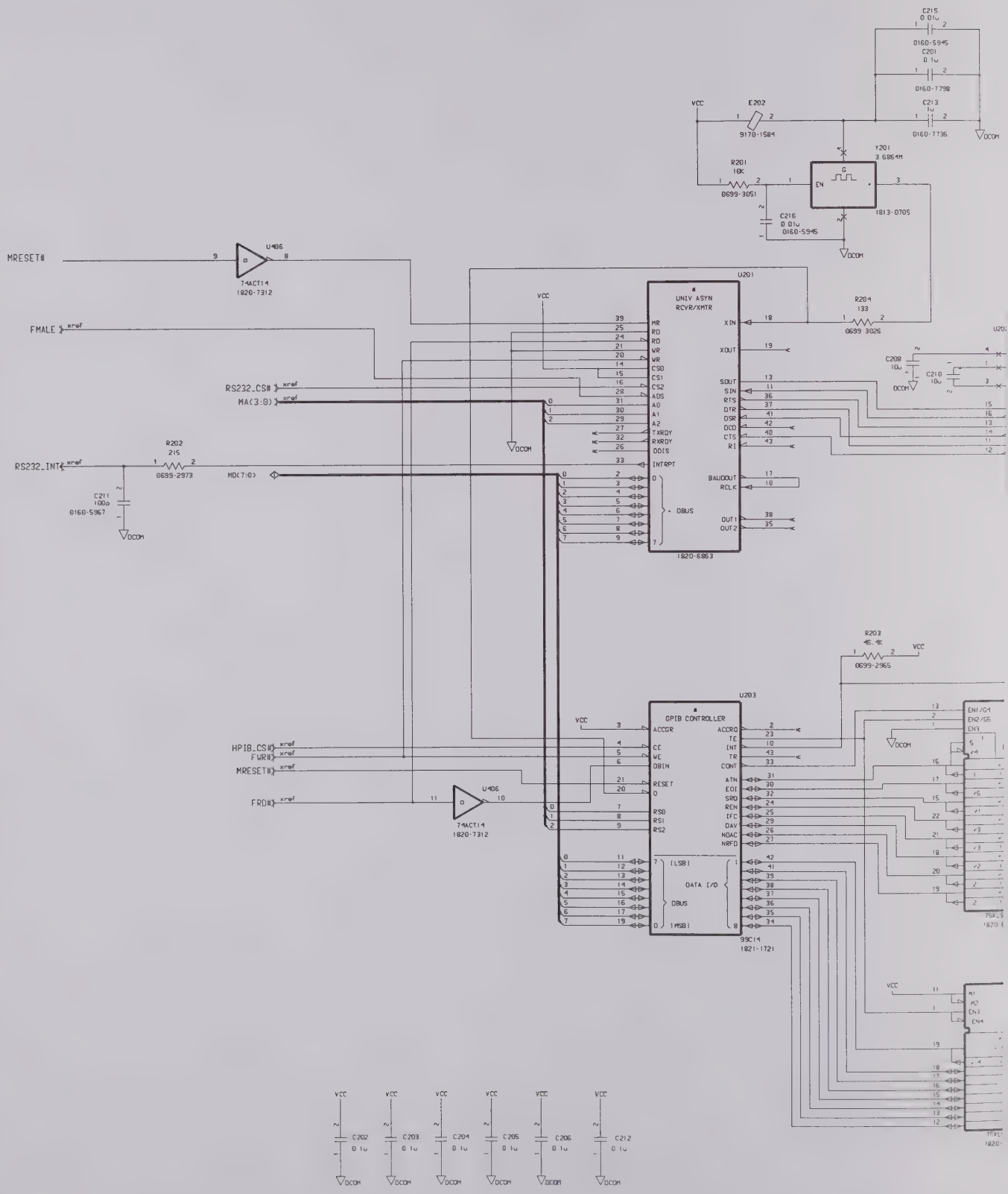


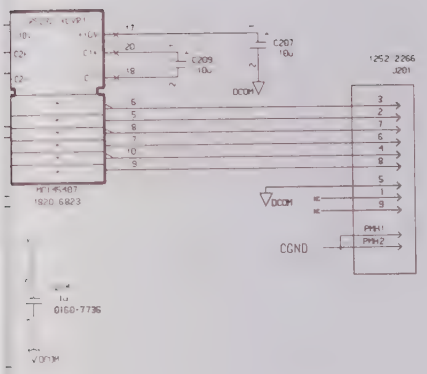
Agilent 3499A/B Controller PC Board Components Locator

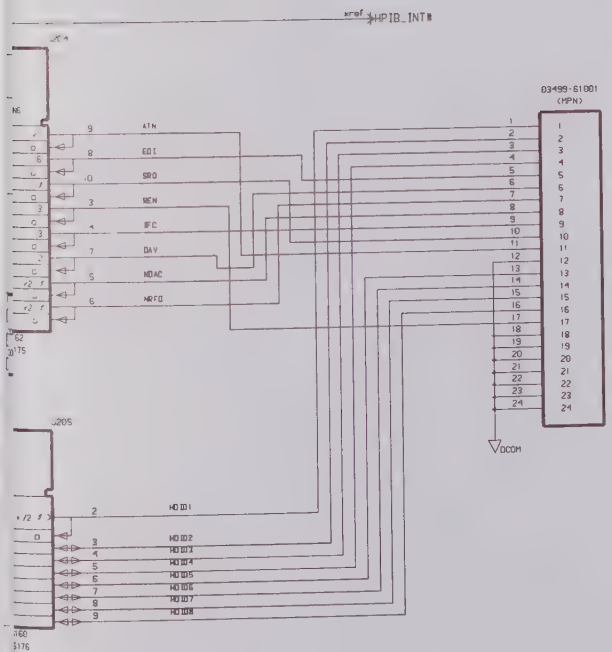

RS232_INT
MPIB_INT
MPRESET
SYSCLK
U101
1826-1857
TL7705ACD
SUPPLY VOLTAGE SUPERVISOR
R130
4.64K
0699-3044
C132
10u 35V
0180-4287
C120
0.1u
R123
4.64K
0699-3044
U112
74ACT14
1820-7312
R101
215
0699-2973
C102
100p
0160-5967
U104
1821-5284
(MPN)
XTAL1
XTAL2
RESET
RPD
ONCE
NMI
EA
ALE
RD
WR/WRL
BHE/WRH
INST
READY
R106 0
0699-2643
R102 0
0699-2643
FRESET
RY_BY
FPGA_PROG
FPGA_CCLK
FPGA_DIN
FPGA_INIT
FPGA_DONE
SRESET
MEXTINT0
MEXTINT1
R108
4.64K
0699-3044
never_load
TP101
U111
REAL TIME CLK
XTAL1
XTAL2
SCLK
RESET
DATA
Y101
32.768K
0410-2153
C103
12p
0160-5976
C104
12p
0160-5976
1821-2109
R112
215
0699-2973
FKB_TXD
R113
215
0699-2973
FKB_RXD
DOUT_ENH1
DOUT_ENH2
DOUT_ENH3
DOUT_ENH4
RP101
4.7K
RP102
4.7K
RP103
4.7K
1810-1128
EXPORT 0/A15
EXPORT 1/A17
EXPORT 2/A18
EXPORT 3/A19
MCS4#
MCS3#
MCS5#
MALE
MREADY
If use 29F800B, load R118 & R116
If use 29F400B, load R117
If use 29F200B, load R117
U107
FLASH MEMORY
8MBIT
A18_RYBY
BYTE (1M X 8)
WORD (512K X 16)
RESET
OE
WE
RY
BY
29F800
1818-6628
AM29F800B-90SC
never_load
LOAD AM29F400B-70SC
U112
74ACT14
1820-7312
R110 0
never_load
R111 0
0699-2643
R116 0
never_load
R114 0
0699-2643
R115 0
0699-2643
+5NV
CR103
1906-0291
R124
8.25K
0699-3049
+5ECC
R119 215
0699-2973
+5BAT
BT101
1420-0254
CR102
1902-1519
3.9
C108
0.1u
C109
0.1u
C114
0.1u
C115
0.1u
C116
0.1u
C118
0.1u
C119
0.1u
C120
0.1u
C111
0.1u
C106
0.1u
C107
0.1u
VCC
DCOM



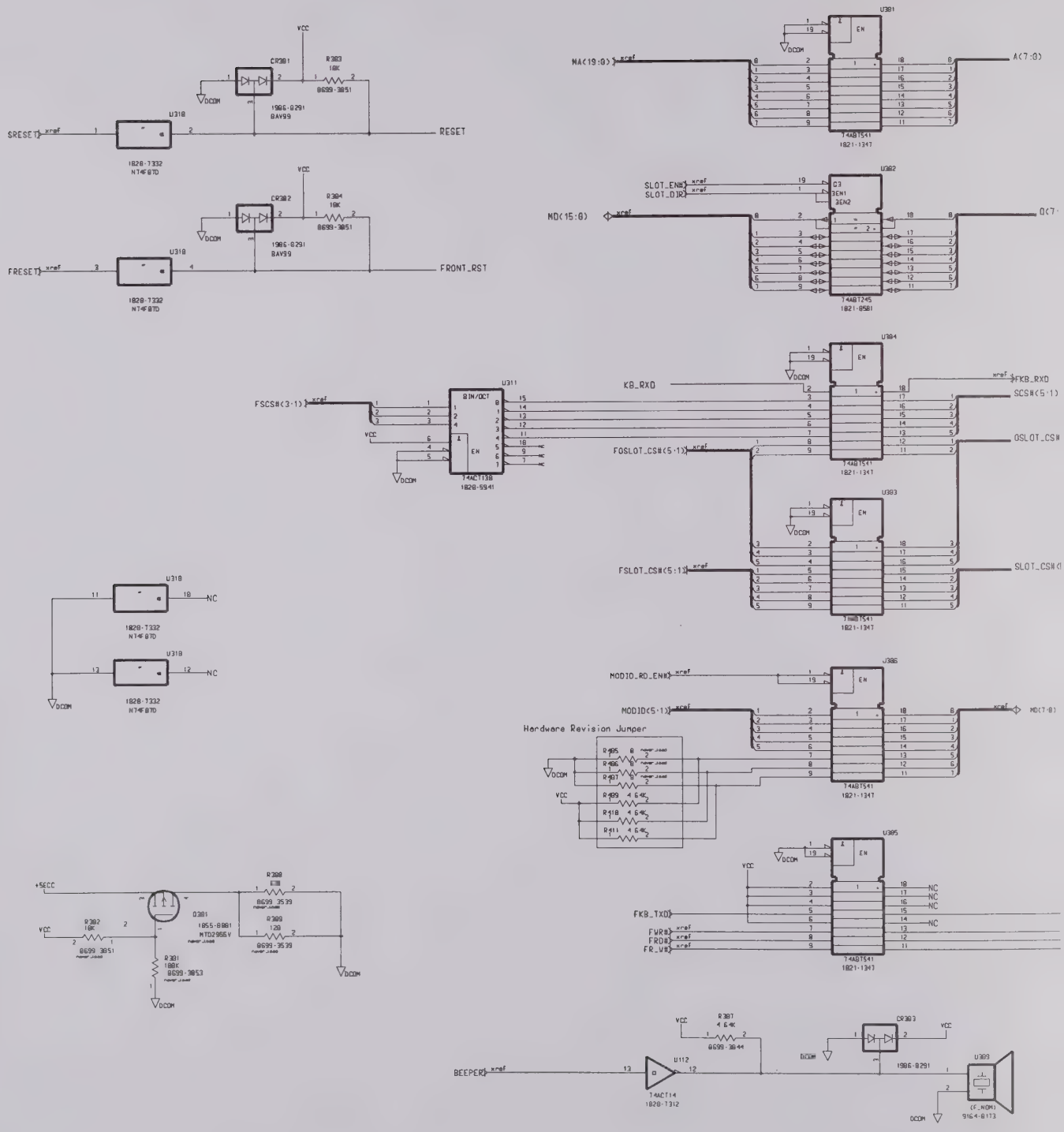
Agilent 3499A/B Controller PC Board
Schematics -- Sheet 1 of 5

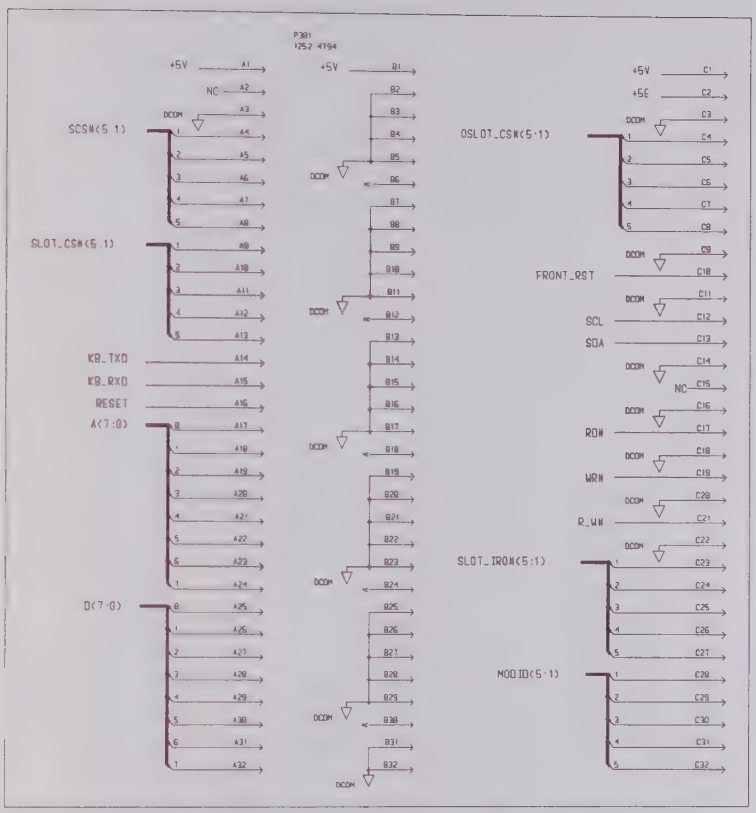

C215
0.01u
0160-5945
C201
0.1u
0160-7798
C213
1u
0160-7736
VCC
E202
9170-1584
DCOM
Y201
3.6864M
R201
10K
0699-3051
G
EN
1813-0705
C216
0.01u
0160-5945
MRESET#
U406
74ACT14
1820-7312
U201
UNIV ASYN
RCVR/XMTR
R204
133
0699-3026
FMALE
xref
RS232_CS#
MA(3:0)
R202
215
0699-2973
RS232_INT#
MD(7:0)
C211
100p
0160-5967
MR
RD
RD
WR
WR
CSD
CS1
CS2
ADS
A0
A1
A2
TXRDY
RXRDY
DDIS
INTRPT
DBUS
XIN
XOUT
SOUT
SIN
RTS
DTR
DSR
DCD
CTS
RI
BAUDOUT
RCLK
OUT1
OUT2
1820-6863
C208
10u
C210
10u
R203
46.4K
0699-2965
U203
GPIB CONTROLLER
HPIB_CS#
FWR#
MRESET#
FRD#
ACCGR
CC
WE
DBIN
RESET
RS0
RS1
RS2
ACCRQ
TE
INT
TR
CONT
ATN
EOI
SRQ
REN
IFC
DAV
NDAC
NRFD
LSBI
DATA I/O
MSBI
99C14
1821-1721
C202
C203
C204
C205
C206
C212
0.1u

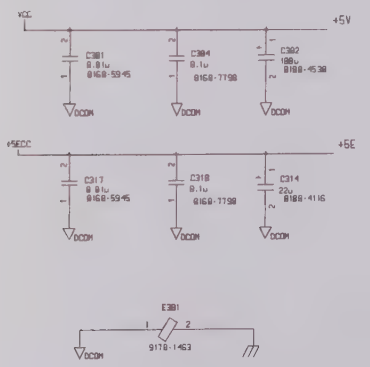


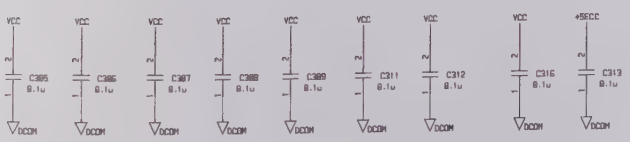


Agilent 3499A/B Controller PC Board
Schematics -- Sheet 2 of 5

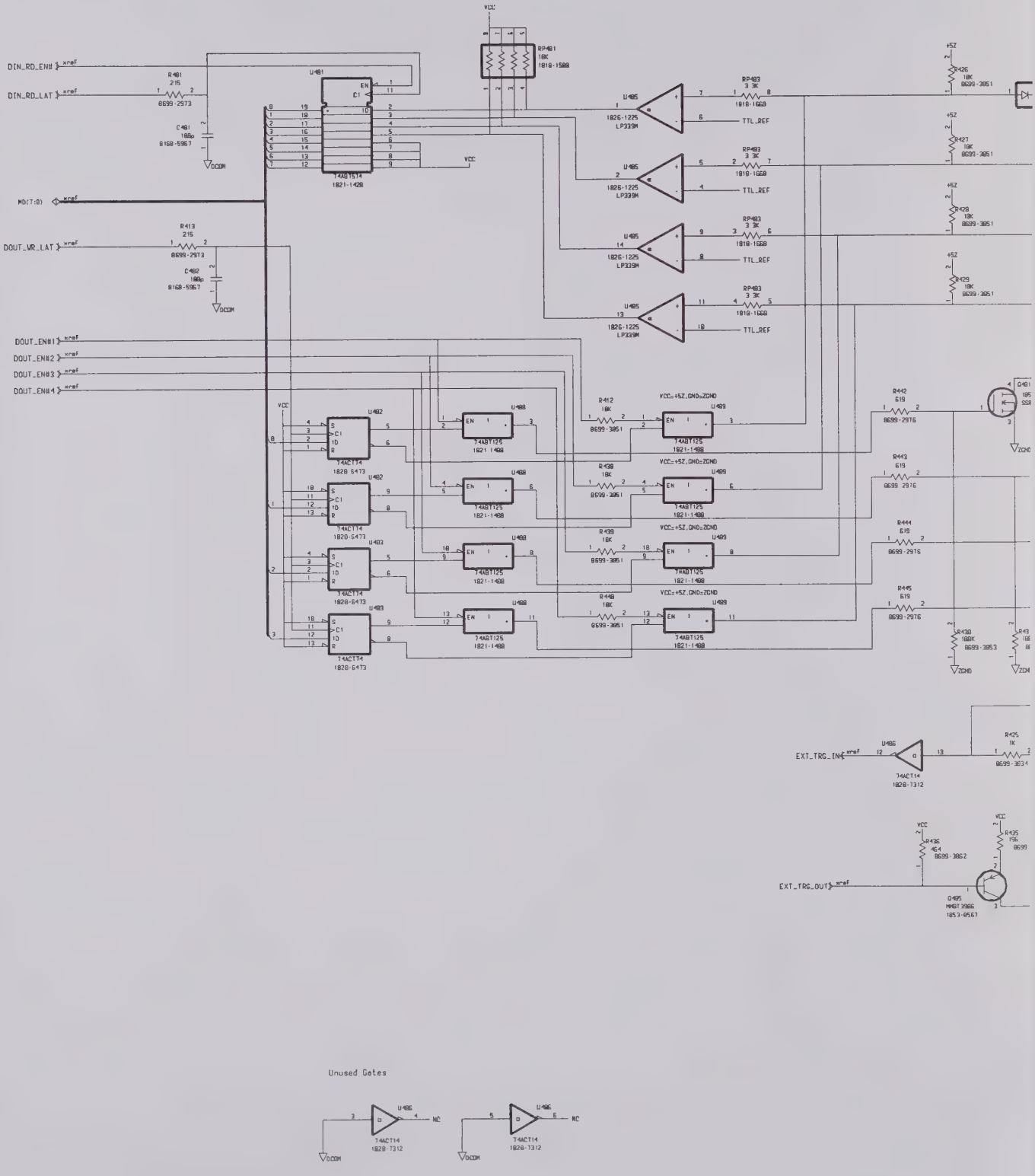

VCC
CR381
R383
16K
8699-3851
1986-0291
BAV99
DCOM
U318
SRESET
xref
RESET
1828-7332
NT4F07D
CR382
R384
FRESET
FRONT_RST
U381
MA(19:0)
A(7:0)
T4ABT541
1821-1347
U382
SLOT_ENA
SLOT_DIR
MD(15:0)
T4ABT245
1821-0581
U384
KB_RXD
FKB_RXD
SCS#(5:1)
FOSLOT_CS#(5:1)
U311
FSCS#(3:1)
BIN/OCT
T4ACT138
1828-5941
U383
FSLOT_CS#(5:1)
U386
MODIO_RD_ENA
MODIO(5:1)
MD(7:0)
Hardware Revision Jumper
R405
R406
R407
R409
R410
R411
4.64K
U385
FKB_TXD
FWR#
FRD#
FR_WR#
NC
+5ECC
R388
8699-3539
D381
1855-0881
NTD2955V
R382
16K
8699-3851
R389
1.2K
R381
180K
8699-3853
U112
BEEPER
T4ACT14
1828-7312
R387
4.64K
8699-3644
CR383
U389
(F_NOM)
9164-0173

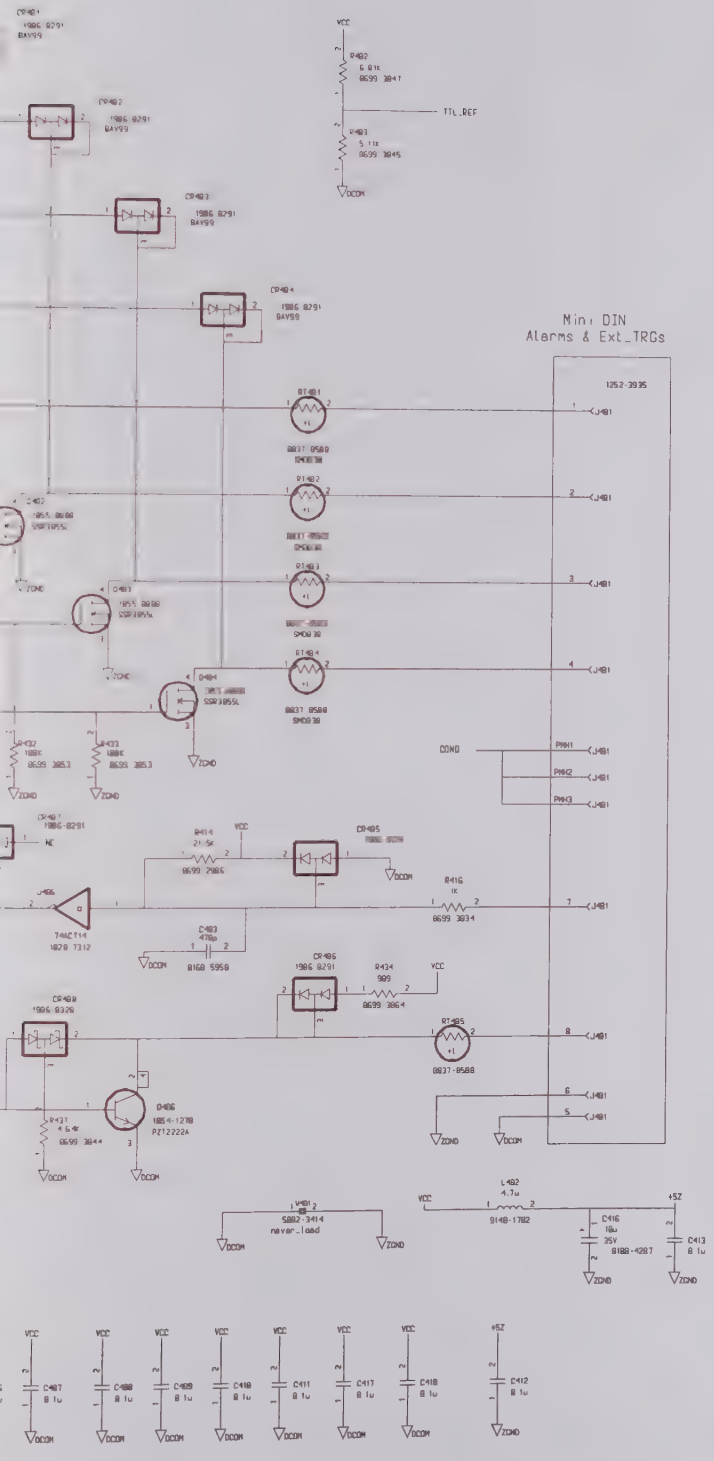




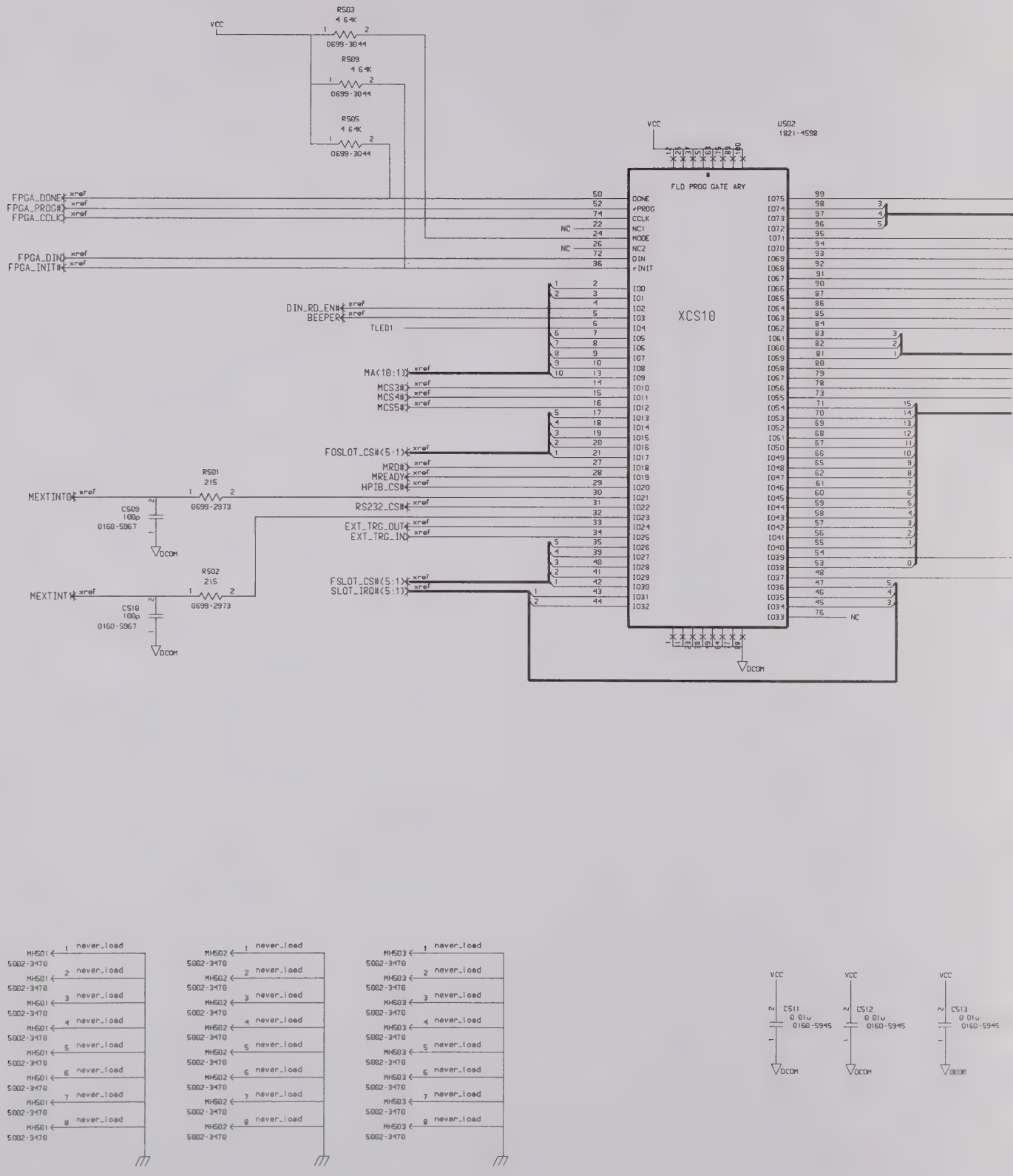


Agilent 3499A/B Controller PC Board
Schematics -- Sheet 3 of 5


DIN_RD_EN#
DIN_RD_LAT
MD(7:0)
DOUT_WR_LAT
DOUT_EN#1
DOUT_EN#2
DOUT_EN#3
DOUT_EN#4
EXT_TRG_IN
EXT_TRG_OUT
VCC
DCOM
ZGND
TTL_REF
Unused Gates
NC

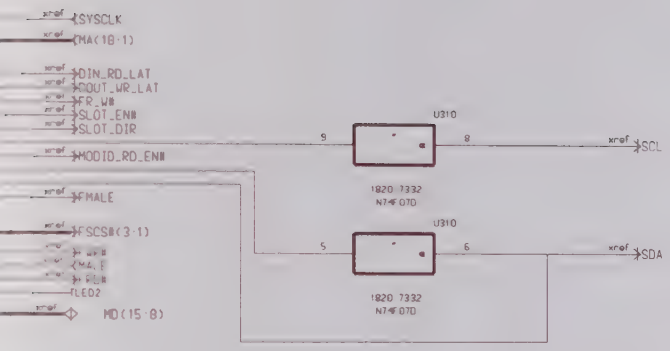


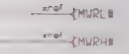
Agilent 3499A/B Controller PC Board
Schematics -- Sheet 4 of 5

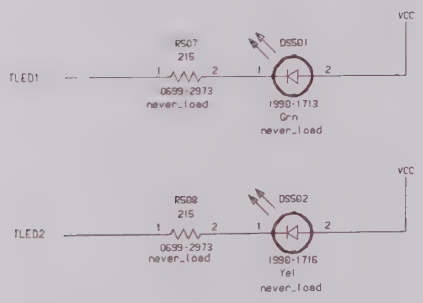

R503
4.64K
0699-3044
R509
4.64K
0699-3044
R505
4.64K
0699-3044
VCC
U502
1821-4598
FLD PROG GATE ARY
XCS10
FPGA_DONE
FPGA_PROG#
FPGA_CCLK
FPGA_DIN
FPGA_INIT#
DIN_RD_EN#
BEEPER
TLED1
MA(10:1)
MCS3#
MCS4#
MCS5#
FOSLOT_CS#(5:1)
MRD#
MREADY
HPIB_CS#
RS232_CS#
EXT_TRG_OUT
EXT_TRG_IN
FSLOT_CS#(5:1)
SLOT_IRQ#(5:1)
MEXTINT0
MEXTINT
R501
215
0699-2973
R502
215
0699-2973
C509
100p
0160-5967
C510
100p
0160-5967
DCOM
NC
xref

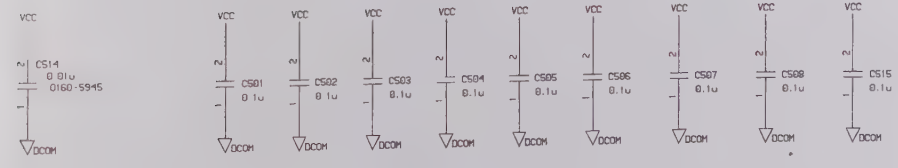
MH501
MH502
MH503
5002-3470
never_load

VCC
C511
C512
C513
0.01u
0160-5945
DCOM



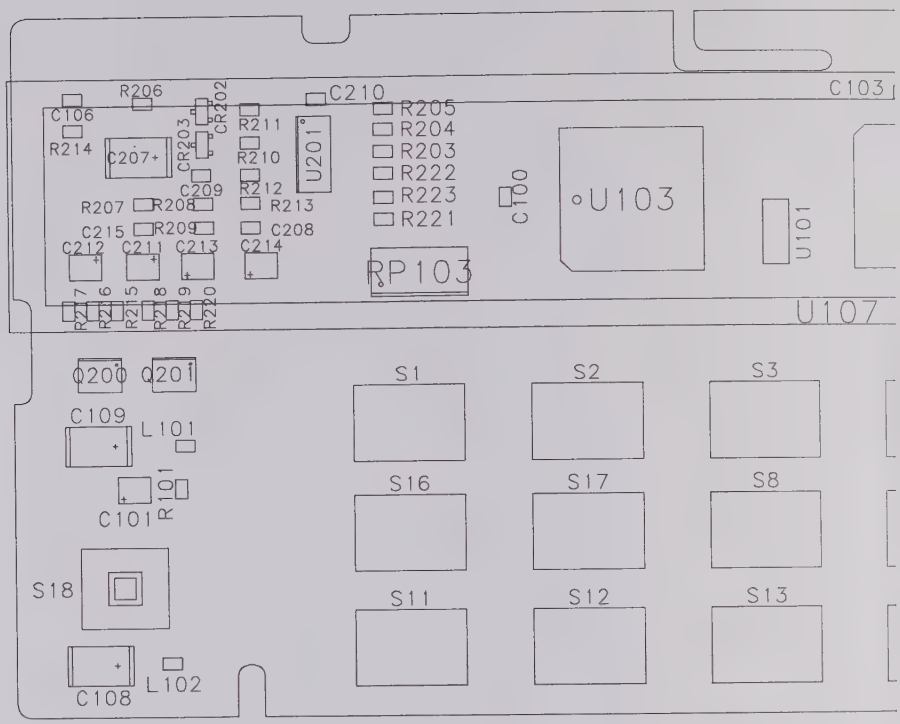




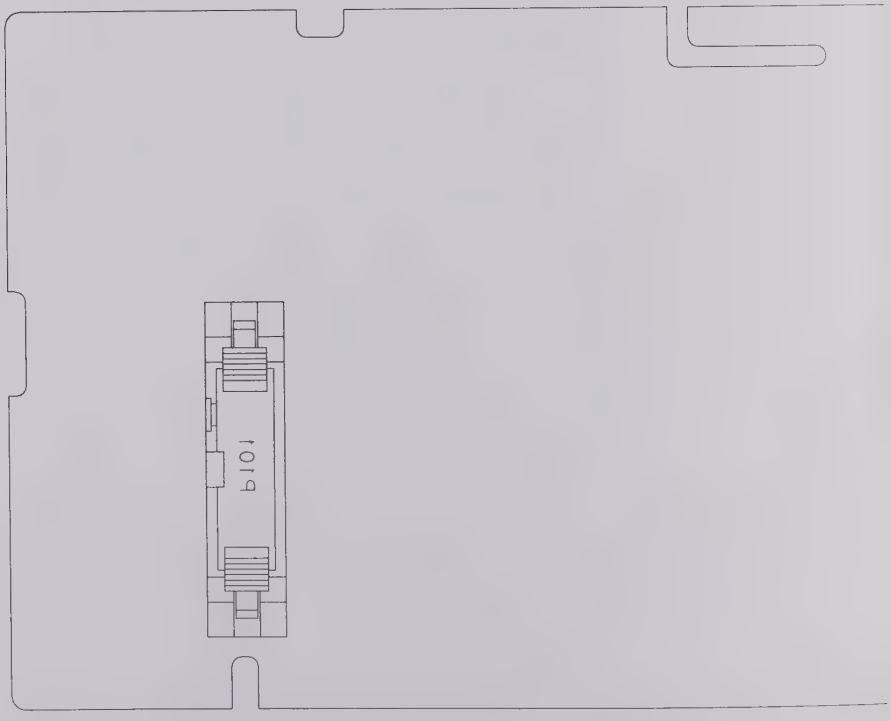


Agilent 3499A/B Controller PC Board
Schematics -- Sheet 5 of 5

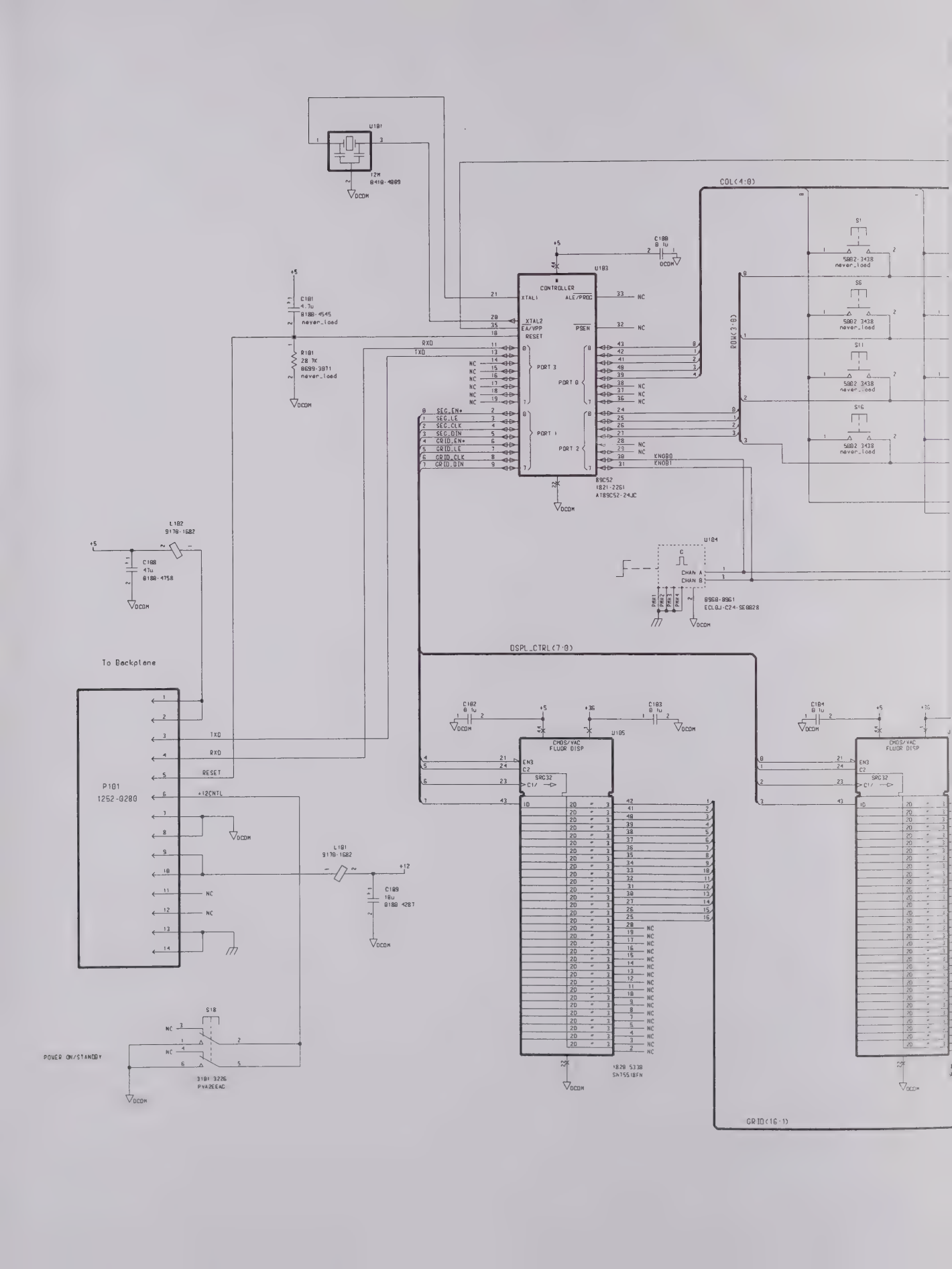
Toplocator

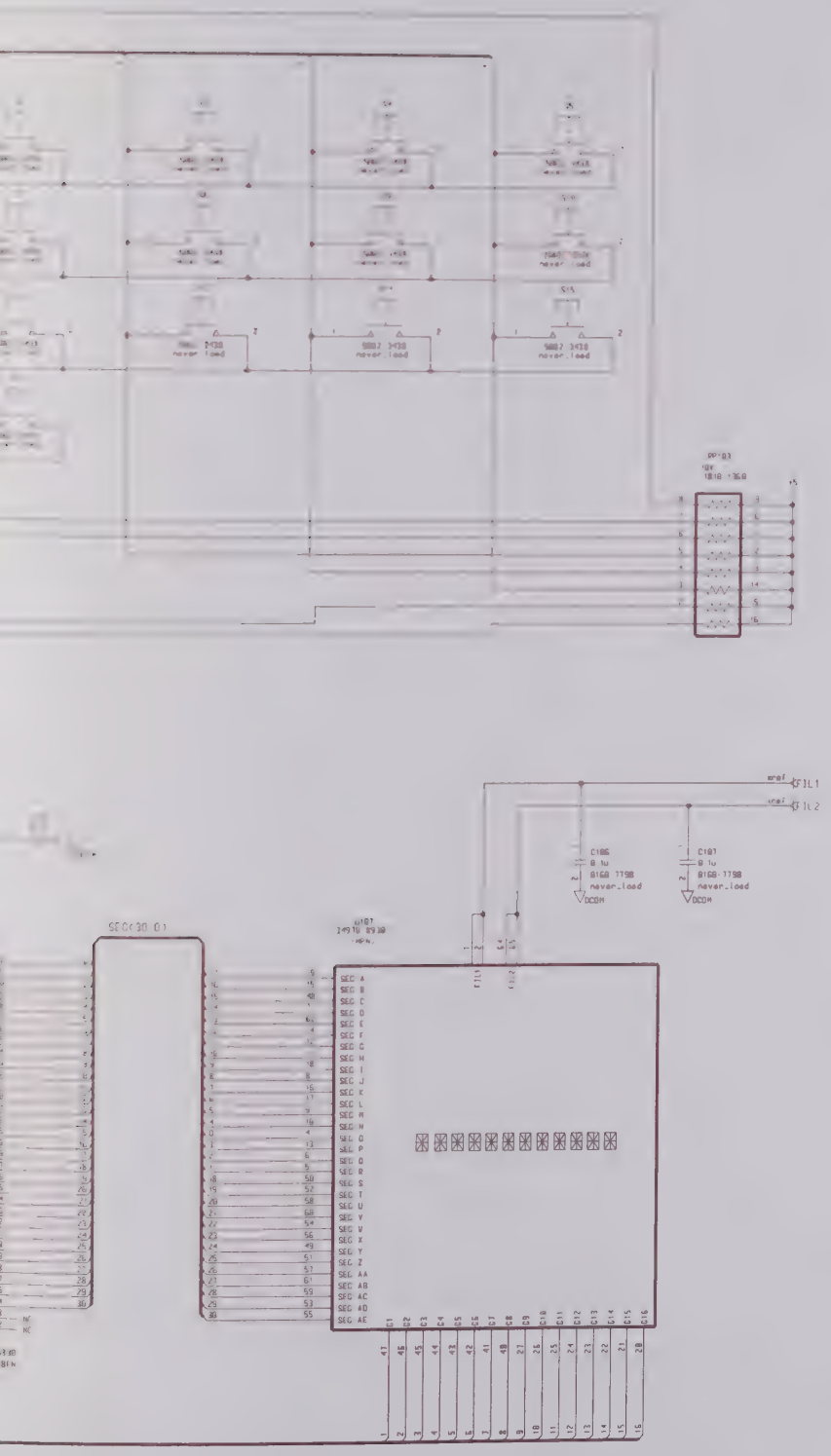


Bottomlocator



Agilent 3499A/B Keyboard & Display Components Locator

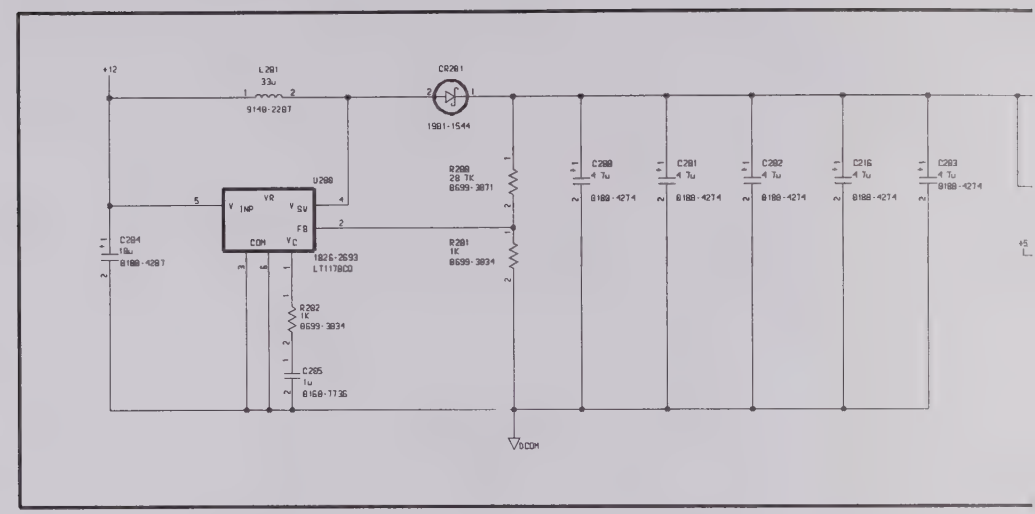

U181
12M
8410-4989
DCOM
+5
C180
0.1u
U183
CONTROLLER
XTAL1
ALE/PROG
XTAL2
EA/VPP
PSEN
RESET
PORT 3
PORT 0
PORT 1
PORT 2
89C52
1821-2251
AT89C52-24JC
C181
4.7u
8188-4545
never_load
R181
28.7K
8699-3871
never_load
RXD
TXD
SEG_EN*
SEG_LE
SEG_CLK
SEG_DIN
GRID_EN*
GRID_LE
GRID_CLK
GRID_DIN
KNOB0
KNOB1
COL(4:0)
ROW(3:0)
S1
S6
S11
S16
5002-3438
never_load
L182
9170-1682
C188
47u
8188-4758
U184
CHAN A
CHAN B
8960-8961
ECLQJ-C24-5E0828
To Backplane
P101
1252-0280
+12CNTL
RESET
L181
9170-1682
+12
C189
10u
8188-4287
S18
POWER ON/STANDBY
3101-3226
PVA2EEAC
DSPL_CTRL(7:0)
C182
0.1u
+36
C183
0.1u
C184
0.1u
U185
CMOS/VAC
FLUOR DISP
EN3
C2
SRC32
C1/
1828-5338
SN75518FN
GRID(16:1)



Agilent 3499A/B Keyboard & Display
Schematics -- Sheet 1 of 2

DC(12v) to DC (36v) Converter

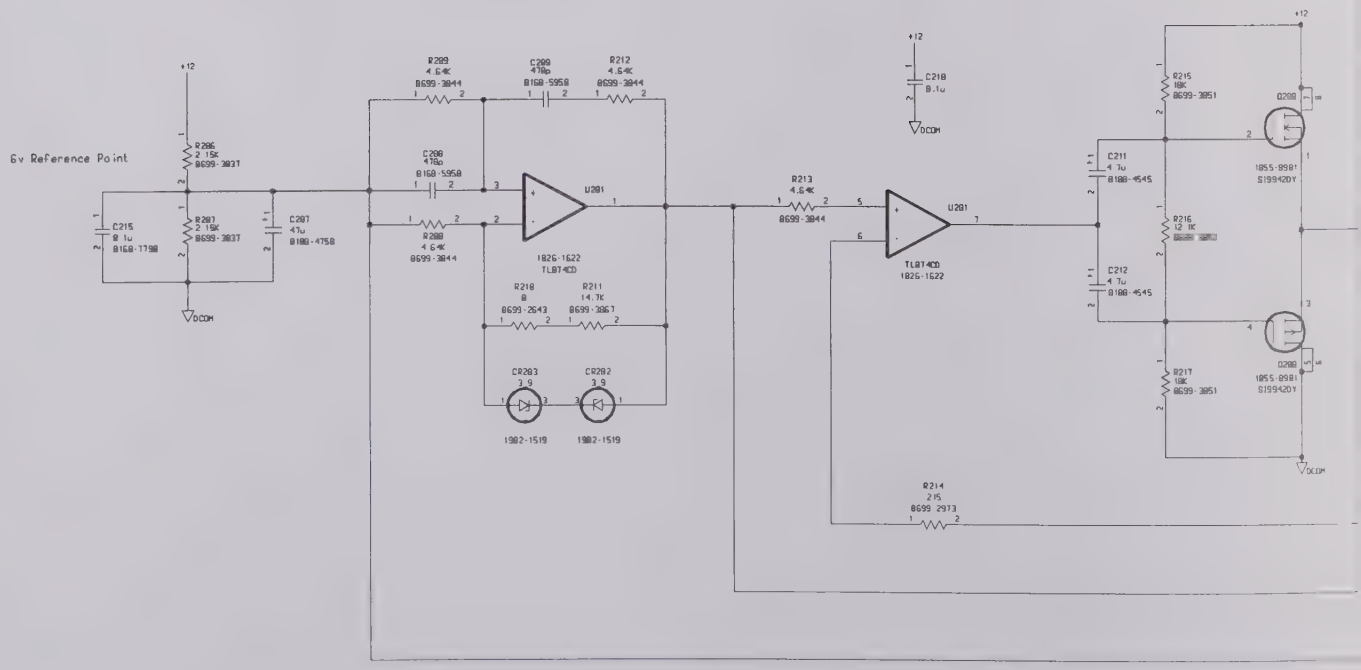
Vo=(1+(R200/R201))*1.24.

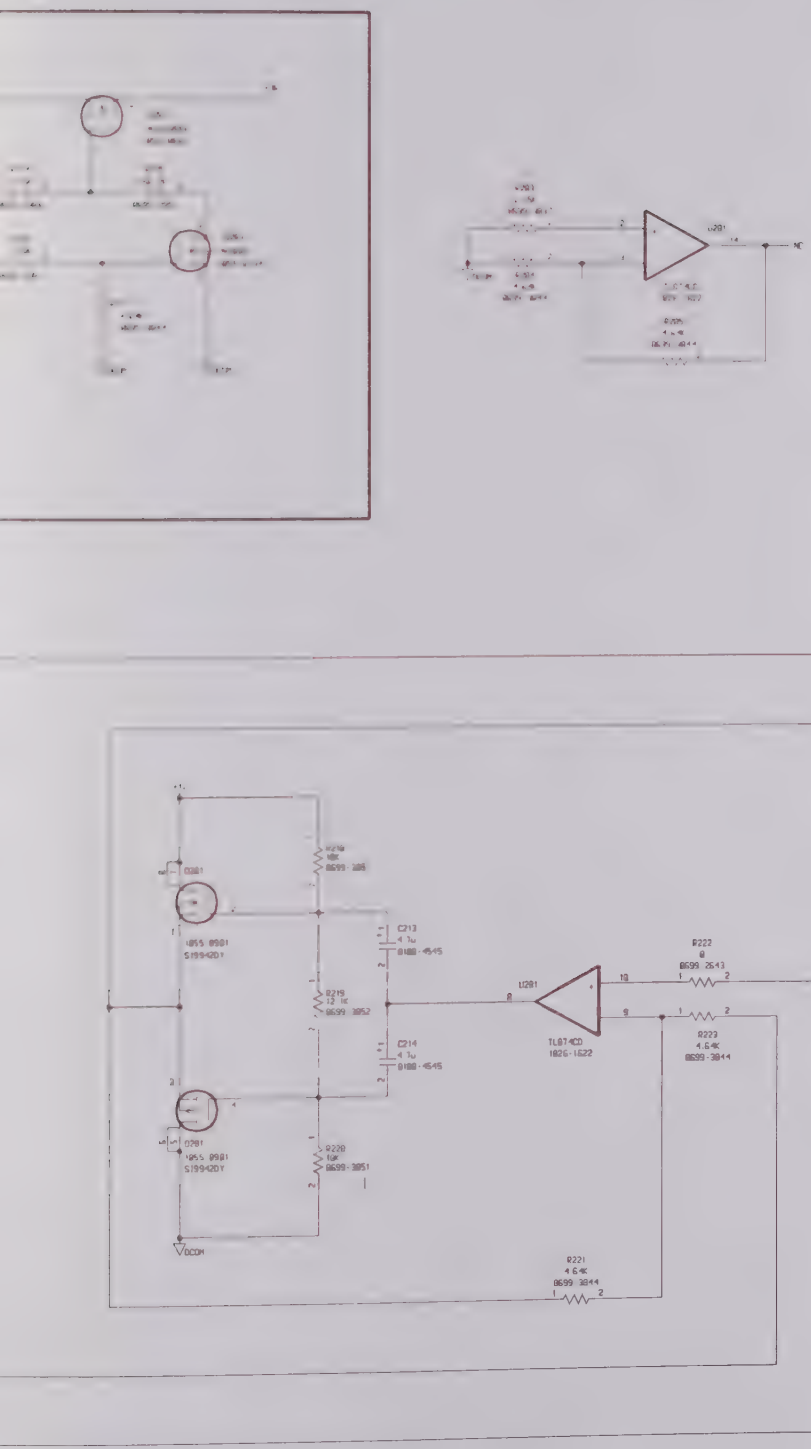


Sine Oscillator

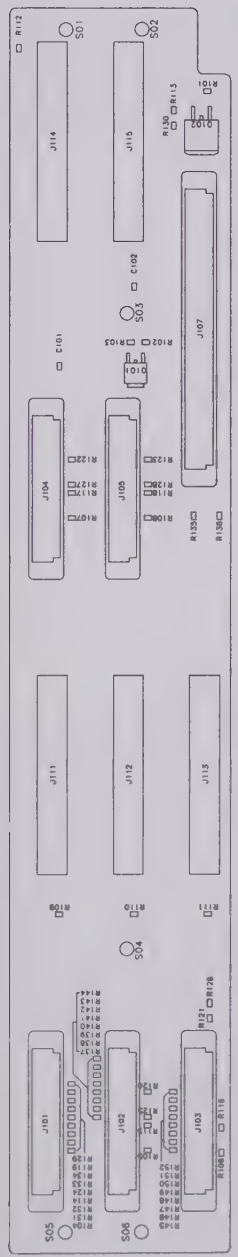
F=1/(2*PI*R209*C208)

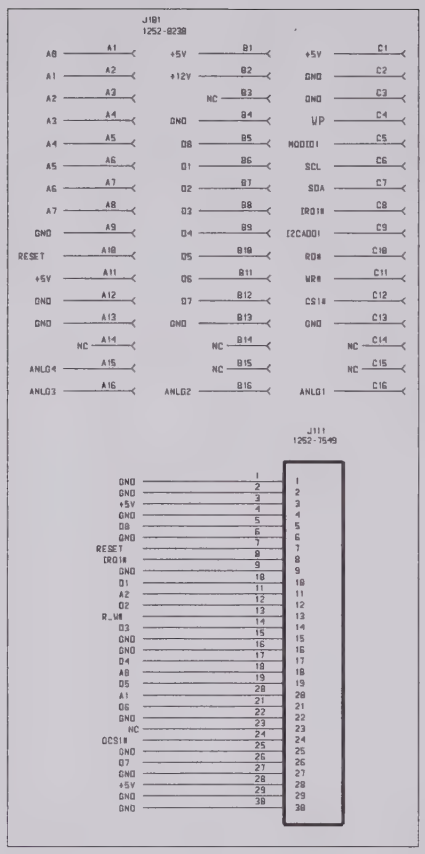
2.0<(R210+R211)/R208)<2.15

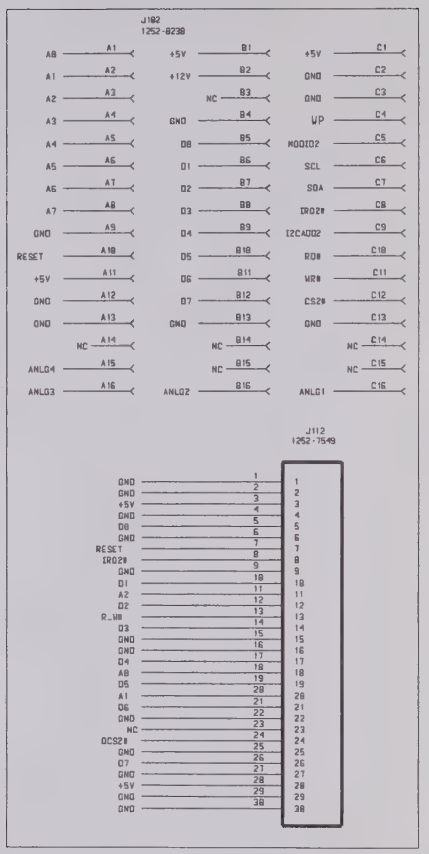


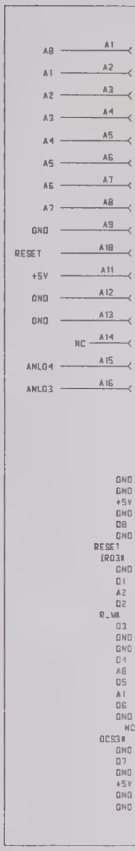


Agilent 3499A/B Keyboard & Display
Schematics -- Sheet 2 of 2




J101
1252-8238
A0 A1 +5V B1 +5V C1
A1 A2 +12V B2 GND C2
A2 A3 NC B3 GND C3
A3 A4 GND B4 WP C4
A4 A5 D8 B5 MODID1 C5
A5 A6 D1 B6 SCL C6
A6 A7 D2 B7 SDA C7
A7 A8 D3 B8 IRQ1# C8
GND A9 D4 B9 I2CADD1 C9
RESET A10 D5 B10 RD# C10
+5V A11 D6 B11 WR# C11
GND A12 D7 B12 CS1# C12
GND A13 GND B13 GND C13
NC A14 NC B14 NC C14
ANLG4 A15 NC B15 NC C15
ANLG3 A16 ANLG2 B16 ANLG1 C16

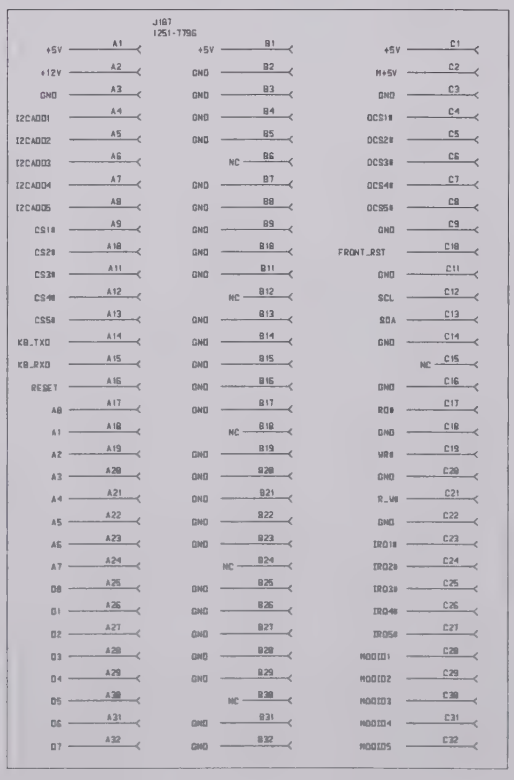

J102
1252-8238
A0 A1 +5V B1 +5V C1
A1 A2 +12V B2 GND C2
A2 A3 NC B3 GND C3
A3 A4 GND B4 WP C4
A4 A5 D8 B5 MODID2 C5
A5 A6 D1 B6 SCL C6
A6 A7 D2 B7 SDA C7
A7 A8 D3 B8 IRQ2# C8
GND A9 D4 B9 I2CADD2 C9
RESET A10 D5 B10 RD# C10
+5V A11 D6 B11 WR# C11
GND A12 D7 B12 CS2# C12
GND A13 GND B13 GND C13
NC A14 NC B14 NC C14
ANLG4 A15 NC B15 NC C15
ANLG3 A16 ANLG2 B16 ANLG1 C16

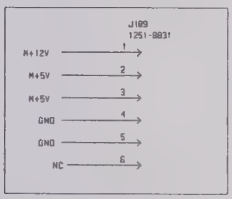

A0 A1
A1 A2
A2 A3
A3 A4
A4 A5
A5 A6
A6 A7
A7 A8
GND A9
RESET A10
+5V A11
GND A12
GND A13
NC A14
ANLG4 A15
ANLG3 A16

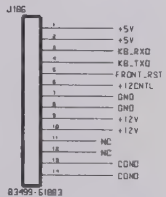
J111
1252-7549
GND 1
GND 2
+5V 3
GND 4
D8 5
GND 6
RESET 7
IRQ1# 8
GND 9
D1 10
A2 11
D2 12
R_W# 13
D3 14
GND 15
GND 16
D4 17
A8 18
D5 19
A1 20
D6 21
GND 22
NC 23
CS1# 24
GND 25
D7 26
GND 27
+5V 28
GND 29
GND 30

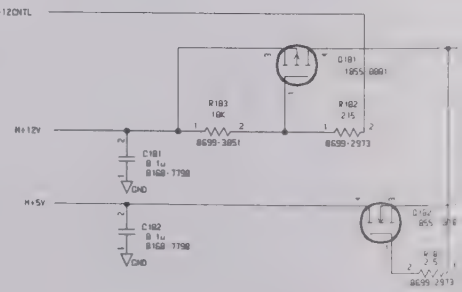
J112
1252-7549
GND 1
GND 2
+5V 3
GND 4
D8 5
GND 6
RESET 7
IRQ2# 8
GND 9
D1 10
A2 11
D2 12
R_W# 13
D3 14
GND 15
GND 16
D4 17
A8 18
D5 19
A1 20
D6 21
GND 22
NC 23
CS2# 24
GND 25
D7 26
GND 27
+5V 28
GND 29
GND 30

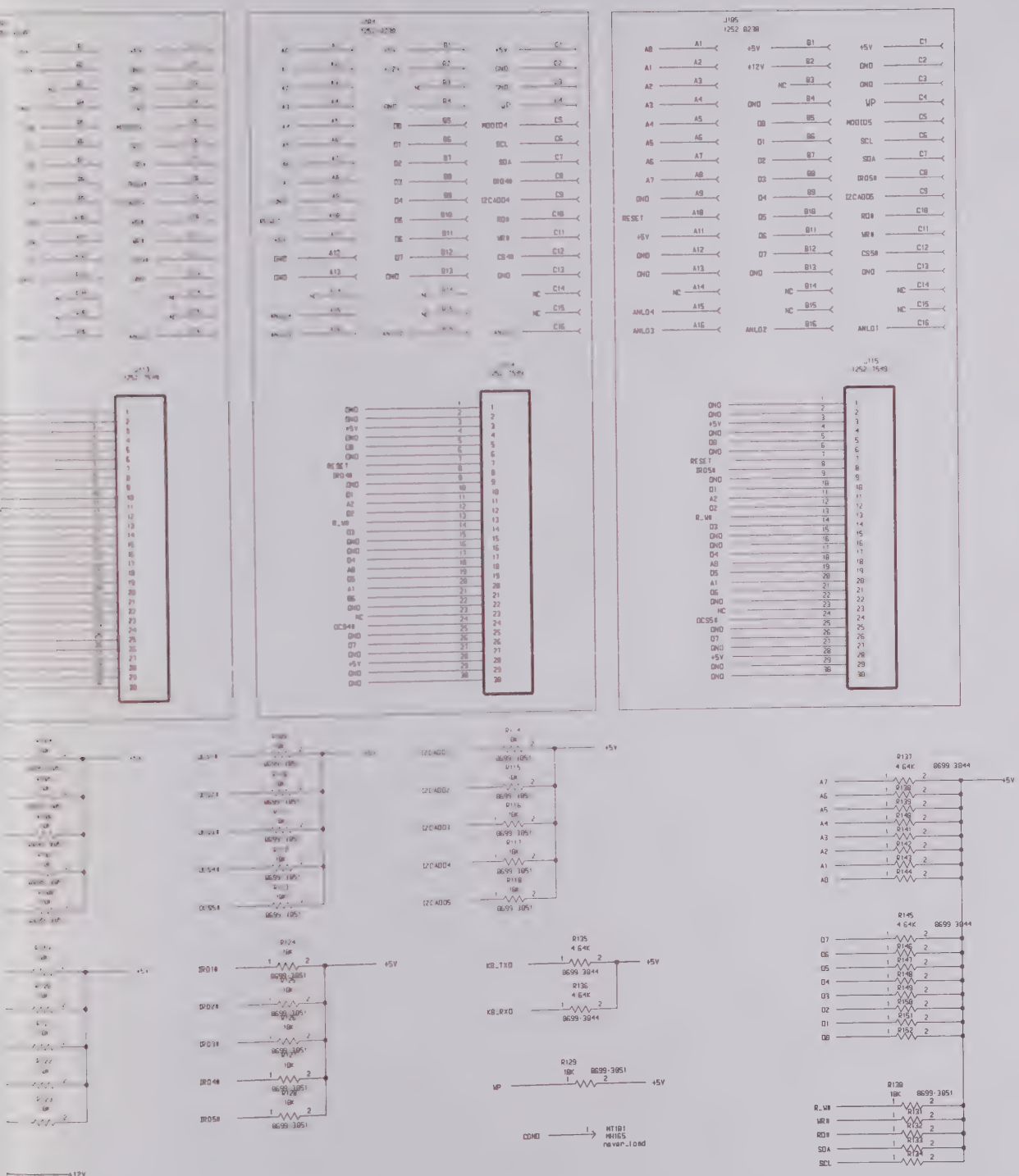
GND
GND
+5V
GND
D8
GND
RESET
IRQ3#
GND
D1
A2
D2
R_W#
D3
GND
GND
D4
A8
D5
A1
D6
GND
NC
CS3#
GND
D7
GND
+5V
GND
GND


J107
1251-7796
+5V A1 +5V B1 +5V C1
+12V A2 GND B2 M+5V C2
GND A3 GND B3 GND C3
I2CADD1 A4 GND B4 OCS1# C4
I2CADD2 A5 GND B5 OCS2# C5
I2CADD3 A6 NC B6 OCS3# C6
I2CADD4 A7 GND B7 OCS4# C7
I2CADD5 A8 GND B8 OCS5# C8
CS1# A9 GND B9 GND C9
CS2# A10 GND B10 FRONT_RST C10
CS3# A11 GND B11 GND C11
CS4# A12 NC B12 SCL C12
CS5# A13 GND B13 SDA C13
KB_TXD A14 GND B14 GND C14
KB_RXD A15 GND B15 NC C15
RESET A16 GND B16 GND C16
A0 A17 GND B17 RD# C17
A1 A18 NC B18 GND C18
A2 A19 GND B19 WR# C19
A3 A20 GND B20 GND C20
A4 A21 GND B21 R_W# C21
A5 A22 GND B22 GND C22
A6 A23 GND B23 IRQ1# C23
A7 A24 NC B24 IRQ2# C24
D8 A25 GND B25 IRQ3# C25
D1 A26 GND B26 IRQ4# C26
D2 A27 GND B27 IRQ5# C27
D3 A28 GND B28 MODID1 C28
D4 A29 GND B29 MODID2 C29
D5 A30 NC B30 MODID3 C30
D6 A31 GND B31 MODID4 C31
D7 A32 GND B32 MODID5 C32

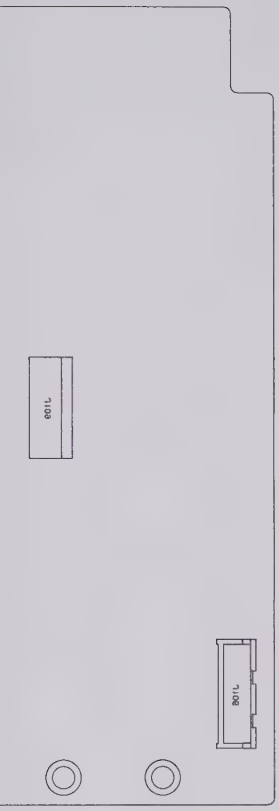

J109
1251-8831
M+12V 1
M+5V 2
M+5V 3
GND 4
GND 5
NC 6

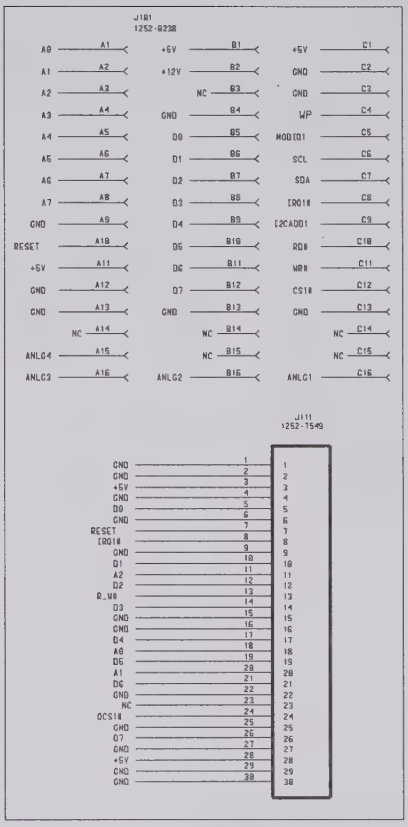

J106
+5V
+5V
KB_RXD
KB_TXD
FRONT_RST
+12CNTL
GND
GND
+12V
+12V
NC
NC
COND
COND
83499-6108B

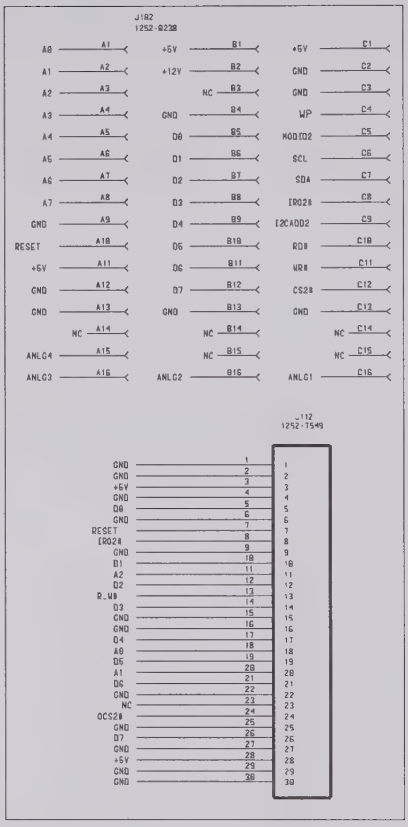

+12CNTL
M+12V
M+5V
R183
10K
R182
215
C181
0.1u
8168-7798
C182
0.1u
8168-7798
GND
GND
8699-3051
8699-2973

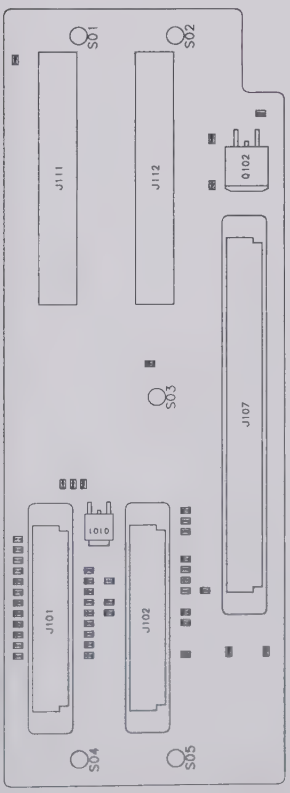


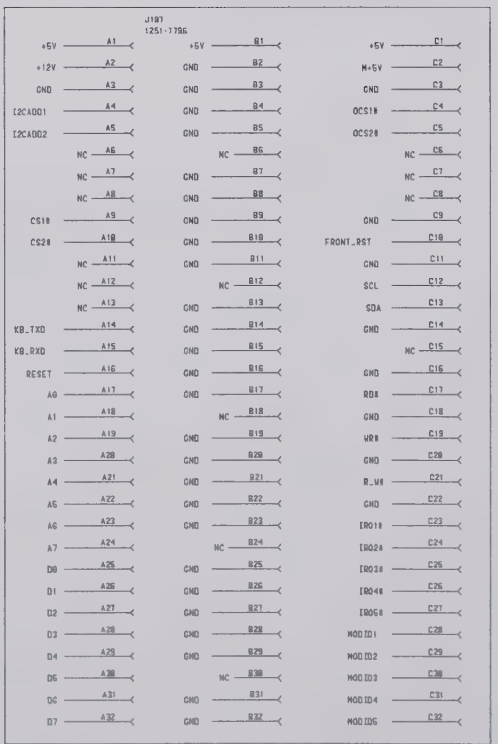
Agilent 3499A Backplane Components
Locator & Schematics

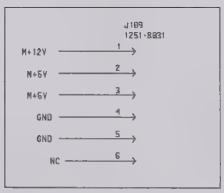

J109
J101

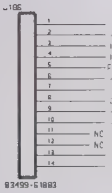

J101
1252-8238
A0 A1 +5V B1 +5V C1
A1 A2 +12V B2 GND C2
A2 A3 NC B3 GND C3
A3 A4 GND B4 WP C4
A4 A5 D0 B5 MODID1 C5
A5 A6 D1 B6 SCL C6
A6 A7 D2 B7 SDA C7
A7 A8 D3 B8 IRQ1# C8
GND A9 D4 B9 I2CADD1 C9
RESET A10 D5 B10 RD# C10
+5V A11 D6 B11 WR# C11
GND A12 D7 B12 CS1# C12
GND A13 GND B13 GND C13
NC A14 NC B14 NC C14
ANLG4 A15 NC B15 NC C15
ANLG3 A16 ANLG2 B16 ANLG1 C16
J111
1252-7549
GND 1 1
GND 2 2
+5V 3 3
GND 4 4
D0 5 5
GND 6 6
RESET 7 7
IRQ1# 8 8
GND 9 9
D1 10 10
A2 11 11
D2 12 12
R_W# 13 13
D3 14 14
GND 15 15
GND 16 16
D4 17 17
A0 18 18
D5 19 19
A1 20 20
D6 21 21
GND 22 22
NC 23 23
CS1# 24 24
GND 25 25
D7 26 26
GND 27 27
+5V 28 28
GND 29 29
GND 30 30

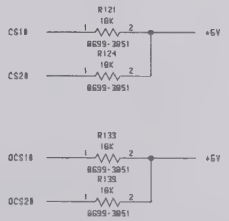

J102
1252-8238
A0 A1 +5V B1 +5V C1
A1 A2 +12V B2 GND C2
A2 A3 NC B3 GND C3
A3 A4 GND B4 WP C4
A4 A5 D0 B5 MODID2 C5
A5 A6 D1 B6 SCL C6
A6 A7 D2 B7 SDA C7
A7 A8 D3 B8 IRQ2# C8
GND A9 D4 B9 I2CADD2 C9
RESET A10 D5 B10 RD# C10
+5V A11 D6 B11 WR# C11
GND A12 D7 B12 CS2# C12
GND A13 GND B13 GND C13
NC A14 NC B14 NC C14
ANLG4 A15 NC B15 NC C15
ANLG3 A16 ANLG2 B16 ANLG1 C16
J112
1252-7549
GND 1 1
GND 2 2
+5V 3 3
GND 4 4
D0 5 5
GND 6 6
RESET 7 7
IRQ2# 8 8
GND 9 9
D1 10 10
A2 11 11
D2 12 12
R_W# 13 13
D3 14 14
GND 15 15
GND 16 16
D4 17 17
A0 18 18
D5 19 19
A1 20 20
D6 21 21
GND 22 22
NC 23 23
CS2# 24 24
GND 25 25
D7 26 26
GND 27 27
+5V 28 28
GND 29 29
GND 30 30


S01
S02
S03
S04
S05
J111
J112
J107
J101
J102
Q102
Q101

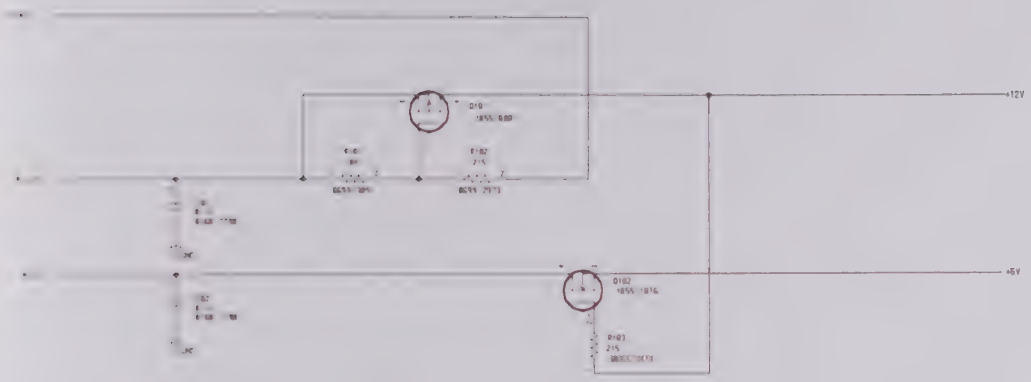

J107
1251-7796
+5V A1 +5V B1 +5V C1
+12V A2 GND B2 M+5V C2
GND A3 GND B3 GND C3
I2CADD1 A4 GND B4 OCS1# C4
I2CADD2 A5 GND B5 OCS2# C5
NC A6 NC B6 NC C6
NC A7 GND B7 NC C7
NC A8 GND B8 NC C8
CS1# A9 GND B9 GND C9
CS2# A10 GND B10 FRONT_RST C10
NC A11 GND B11 GND C11
NC A12 NC B12 SCL C12
NC A13 GND B13 SDA C13
KB_TXD A14 GND B14 GND C14
KB_RXD A15 GND B15 NC C15
RESET A16 GND B16 GND C16
A0 A17 GND B17 RD# C17
A1 A18 NC B18 GND C18
A2 A19 GND B19 WR# C19
A3 A20 GND B20 GND C20
A4 A21 GND B21 R_W# C21
A5 A22 GND B22 GND C22
A6 A23 GND B23 IRQ1# C23
A7 A24 NC B24 IRQ2# C24
D0 A25 GND B25 IRQ3# C25
D1 A26 GND B26 IRQ4# C26
D2 A27 GND B27 IRQ5# C27
D3 A28 GND B28 MODID1 C28
D4 A29 GND B29 MODID2 C29
D5 A30 NC B30 MODID3 C30
D6 A31 GND B31 MODID4 C31
D7 A32 GND B32 MODID5 C32

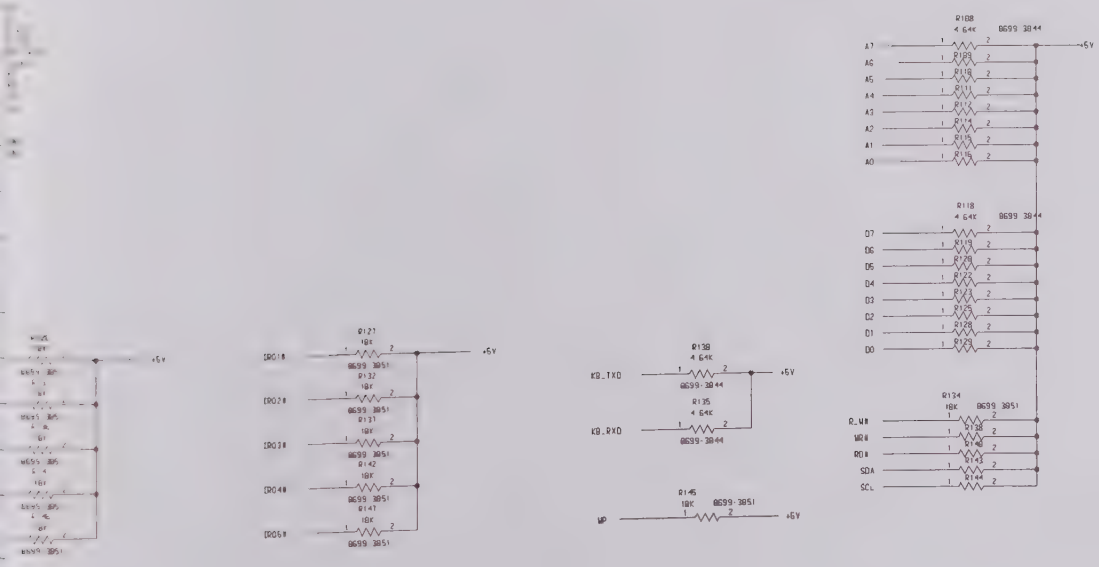

J108
1251-8831
M+12V 1
M+5V 2
M+5V 3
GND 4
GND 5
NC 6


J105
83499-61003
NC
NC


R121
10K
8699-3051
CS1#
+5V
R124
10K
8699-3051
CS2#
R133
10K
8699-3051
OCS1#
+5V
R139
10K
8699-3051
OCS2#
R148
10K
8699-3051
I2CADD1
+5V
R149
10K
8699-3051
I2CADD2
CGND
MT182
MW165
never_load
CGND
MT183
MW165
never_load

MODID1
MODID2
MODID3
MODID4
MODID5


+12V
+5V


R127
R132
R137
R142
R147
R138
R135
KB_TXD
KB_RXD
R145
WP
R108
R109
R110
R111
R112
R113
R114
R115
R116
R118
R119
R120
R121
R122
R123
R124
R125
R126
R129
R134
R140
R143
R144
R_WR
WR
RD
SDA
SCL
+5V
8699-3851
8699-3844

P400
MH400
MH401
C403
L401
C402
U102
U101
U103
U104
U105
U106
U107
U100
U108
C100
C101
C102
C103
C104
C105
C106
C107
C108
C109
C110
C111
C112
C113
C114
C115
C116
L400
C400
C401
R110
R111
R112
R113
R114
R141
R142
R143
R144
R145
R146
R150
R151
R152
R153
R154
R155
R156
R157
R109
R108
R107
R106
R105
CR100
CR101
CR241
CR242
CR243
CR244
CR245
CR246
CR247
CR248
Q221
Q222
Q223
Q230
Q231
Q232
Q233
C200
C201
C202
C203
C204
C205
C206
C207
C208
C209
C210
C211
C212
C213
C214
C215
C216
R240
R241
R242
R243
K342
K343
K300
K301
K302
K303
K304
K305
K306
K307
K308
K309
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K311
K312
K313
K314
K315
K316
K317
K318
K319
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K321
K322
K323
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K325
K326
K327
K328
K329
K330
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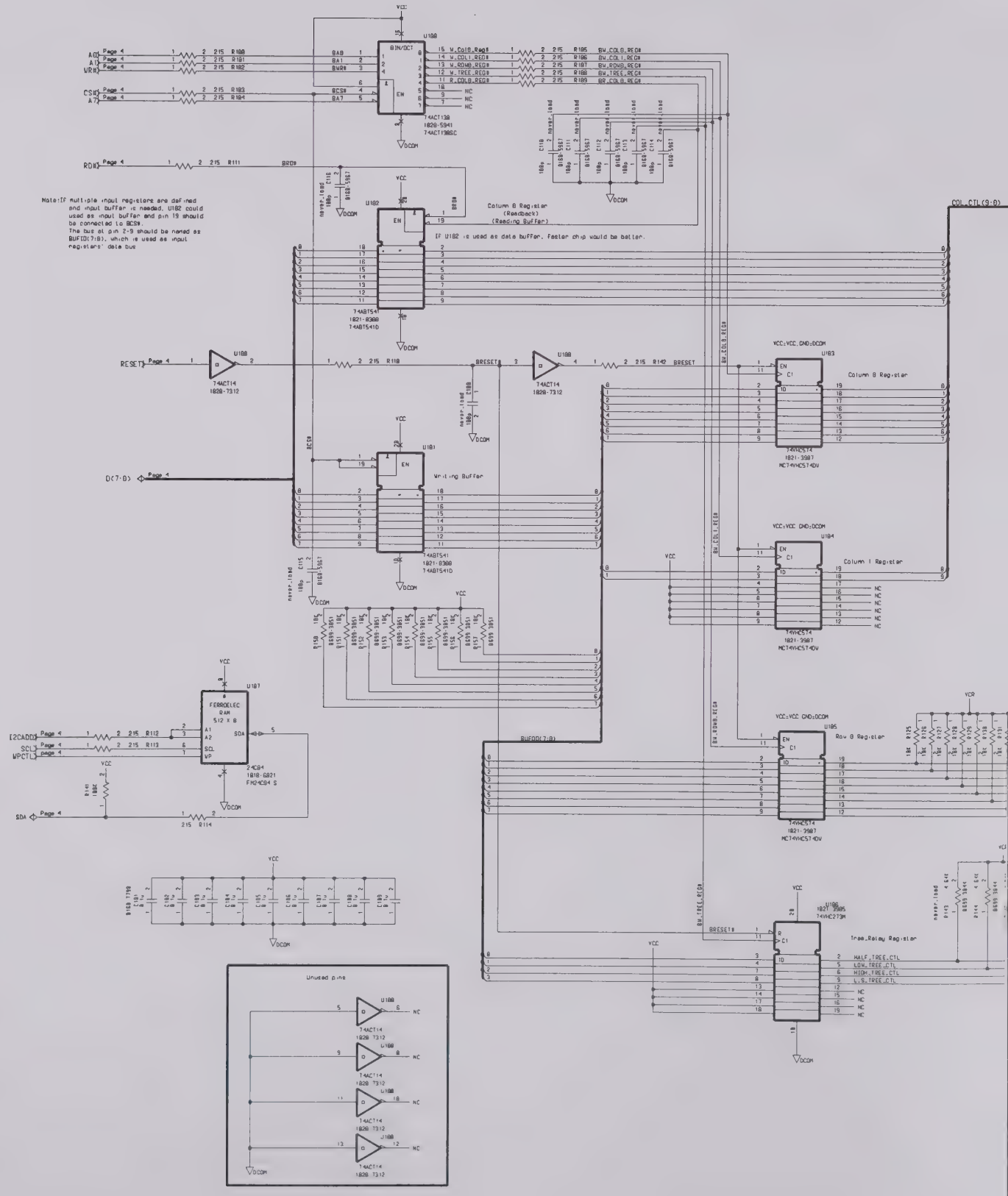
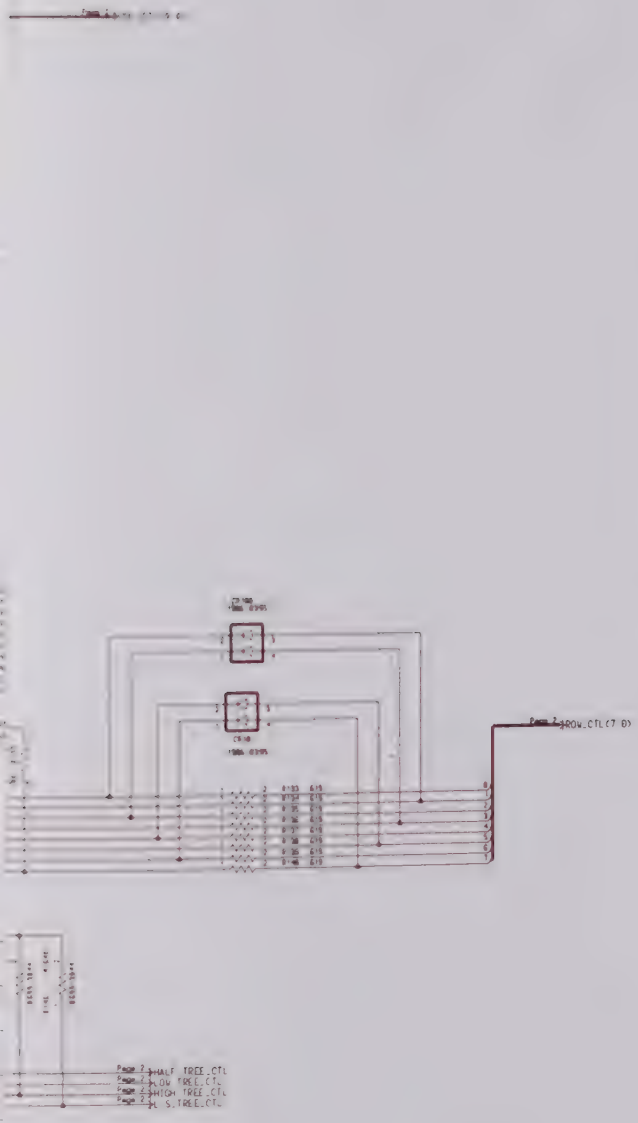
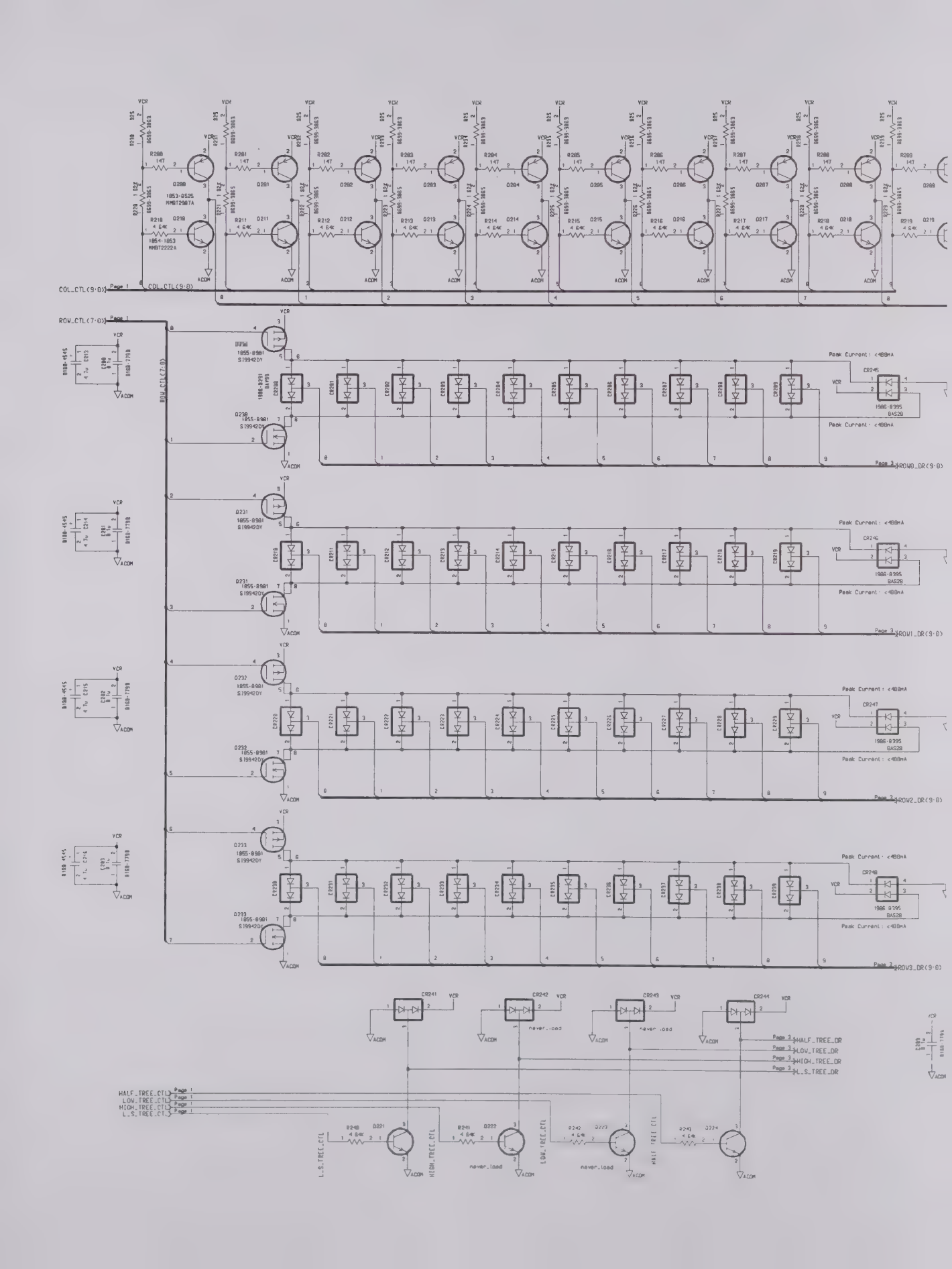
K333
K334
K335
K336
K337
K338
K339

Agilent N2260A 40-Channel MUX Module
Components Locator


Note:IF multiple input registers are defined and input buffer is needed, U182 could used as input buffer and pin 19 should be connected to BCS9.
The bus at pin 2-9 should be named as BUFFD(7:0), which is used as input registers' data bus
Column B Register (Readback) (Reading Buffer)
IF U182 is used as data buffer, faster chip would be better.
COL_CTL(9:0)
Writing Buffer
Column B Register
Column 1 Register
Row 0 Register
Trace_Relay Register
HALF_TREE_CTL
LOW_TREE_CTL
HIGH_TREE_CTL
L.S._TREE_CTL
Unused pins
FERROELEC RAM 512 X 8
24C04
74ACT138
74ACT14
74ABT541
74VHC574
74VHC273M



Agilent N2260A 40-Channel MUX Module
Schematics -- Sheet 1 of 4

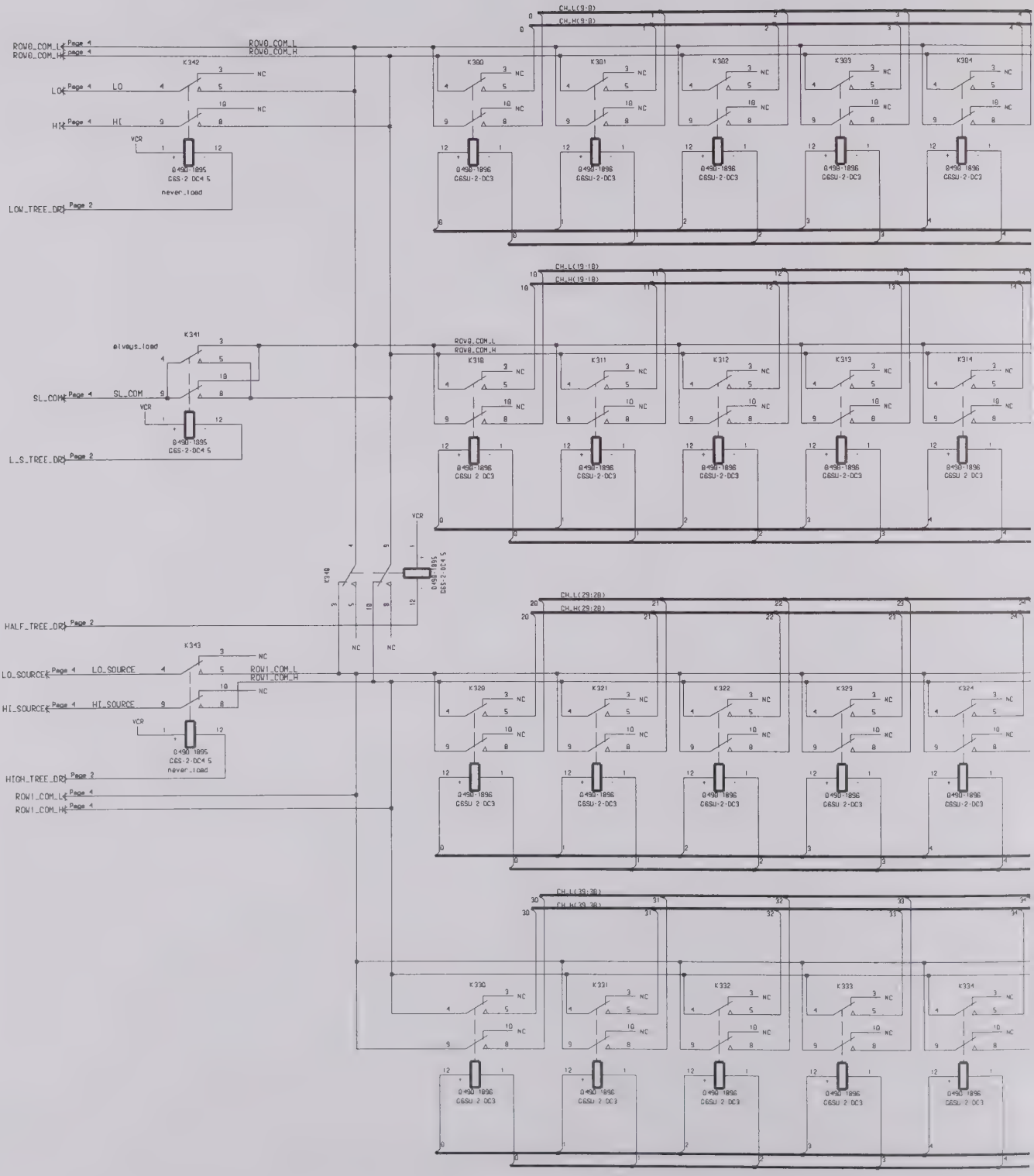

COL_CTL(9:0)
ROW_CTL(7:0)
ACOM
VCR
Peak Current: <400mA
HALF_TREE_CTL
LOW_TREE_CTL
HIGH_TREE_CTL
L.S_TREE_CTL
never_load

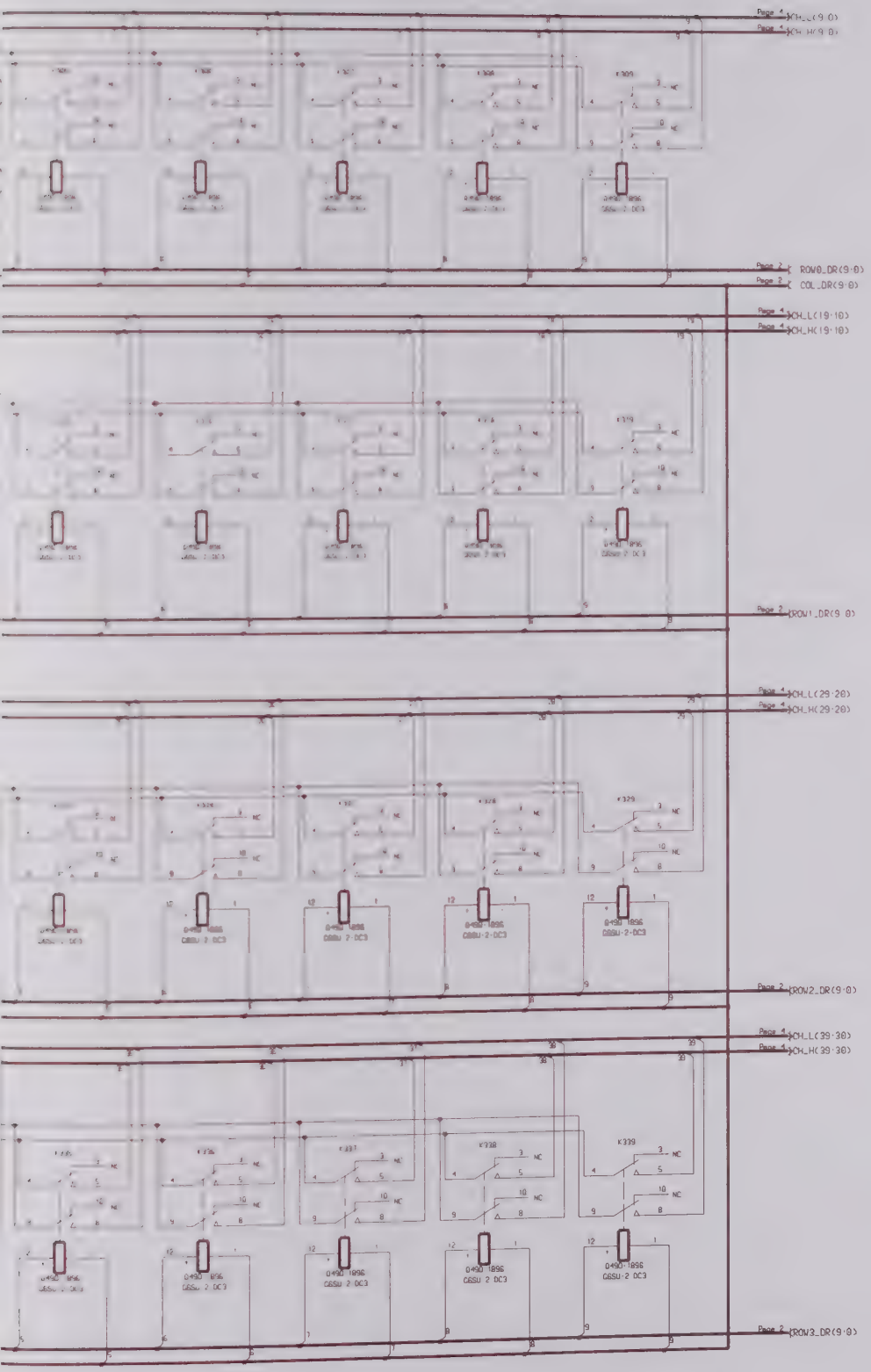
Note

Digital signals should be as far away as possible from RELAY TRACES

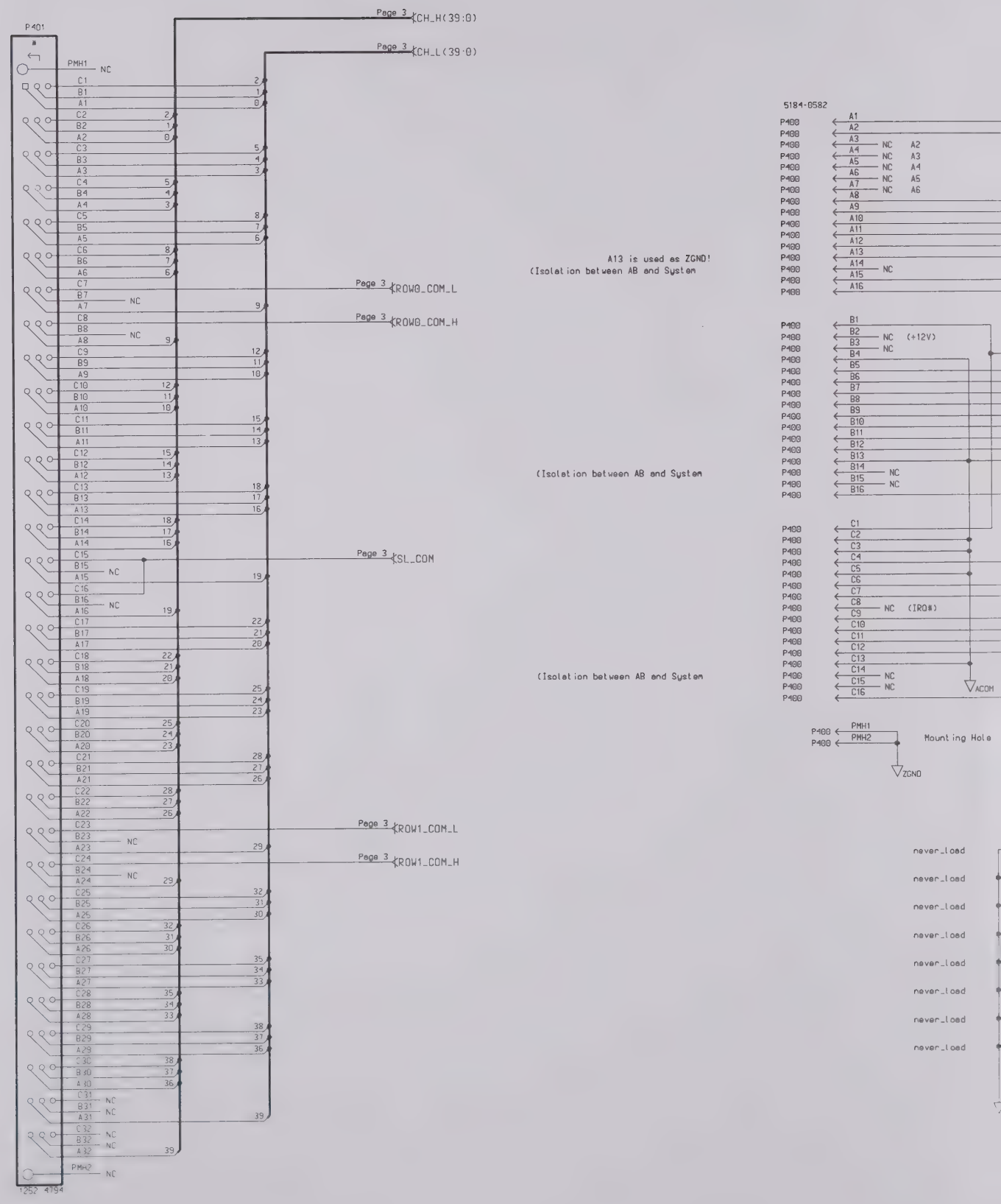
Note

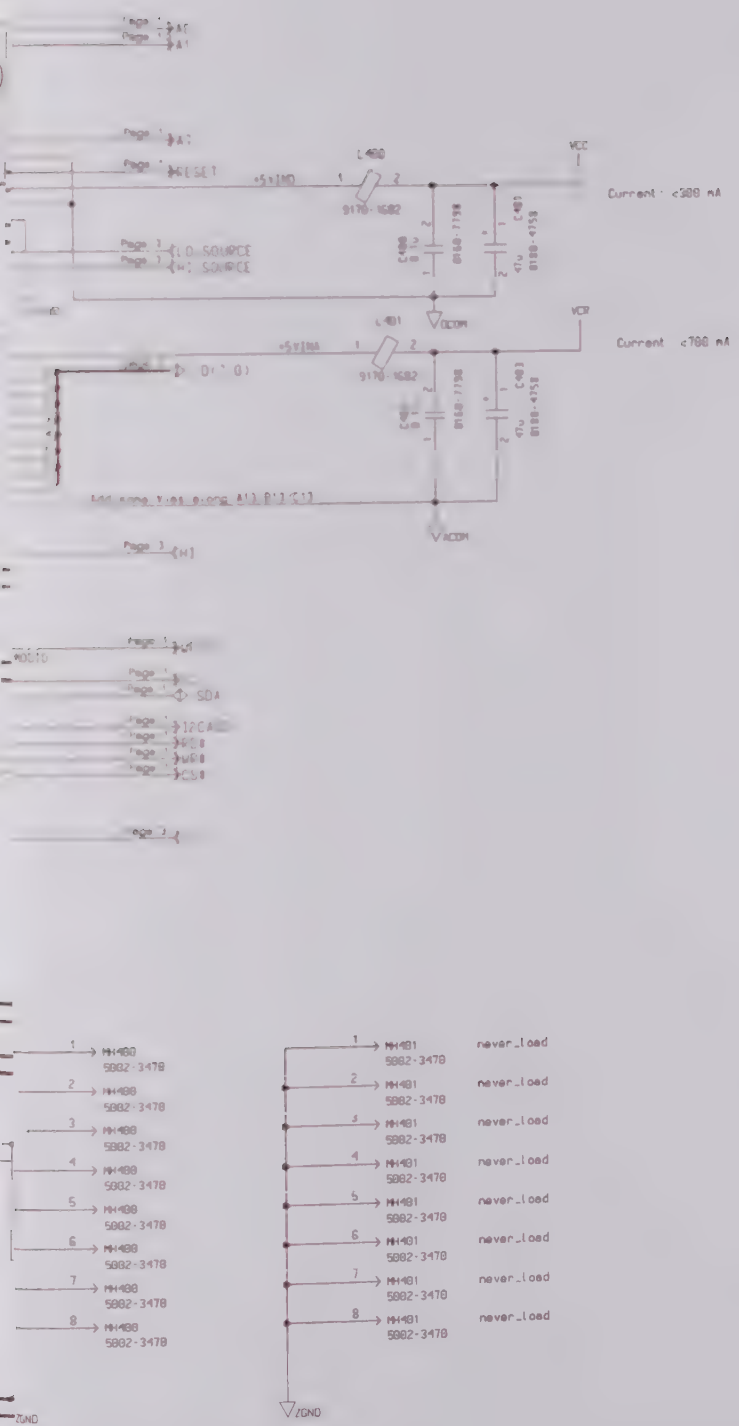
Please enlarge the pad of CR245/CR248 and pin 1,3,5,6,7,8 of D238-D233


ROW8_COM_L
ROW8_COM_H
LO
HI
LOW_TREE_DRY
never_load
always_load
SL_COM
L_S_TREE_DRY
HALF_TREE_DRY
LO_SOURCE
HI_SOURCE
HIGH_TREE_DRY
ROW1_COM_L
ROW1_COM_H
CH_L(9:0)
CH_H(9:0)
CH_L(19:10)
CH_H(19:10)
CH_L(29:20)
CH_H(29:20)
CH_L(39:30)
CH_H(39:30)
0490-1896 CGSU-2-DC3
0490-1895 CGS-2-DC4.5
Relay Specification : 1A/200V



Agilent N2260A 40-Channel MUX Module
Schematics -- Sheet 3 of 4


P401
PMH1
NC
Page 3 CH_H(39:0)
Page 3 CH_L(39:0)
Page 3 ROW0_COM_L
Page 3 ROW0_COM_H
Page 3 SL_COM
Page 3 ROW1_COM_L
Page 3 ROW1_COM_H
PMH2
NC
1252 4194
5184-0582
A13 is used as ZGND!
(Isolation between AB and System
(Isolation between AB and System
(Isolation between AB and System
P400
(+12V)
(IRQ#)
ACOM
PMH1
PMH2
Mounting Hole
ZGND
never_load



Agilent N2260A 40-Channel MUX Module
Schematics -- Sheet 4 of 4

(CONNECT TO P401)
P100
FOR MULTIPLEXER
J107
J106
J105
J104
J103
J102
J101
J100
SCOM
SCOM
COM0
COM1
CH00
CH01
CH02
CH03
CH04
CH05
CH06
CH07
CH08
CH09
CH10
CH11
CH12
CH13
CH14
CH15
CH16
CH17
CH18
CH19
CH20
CH21
CH22
CH23
CH24
CH25
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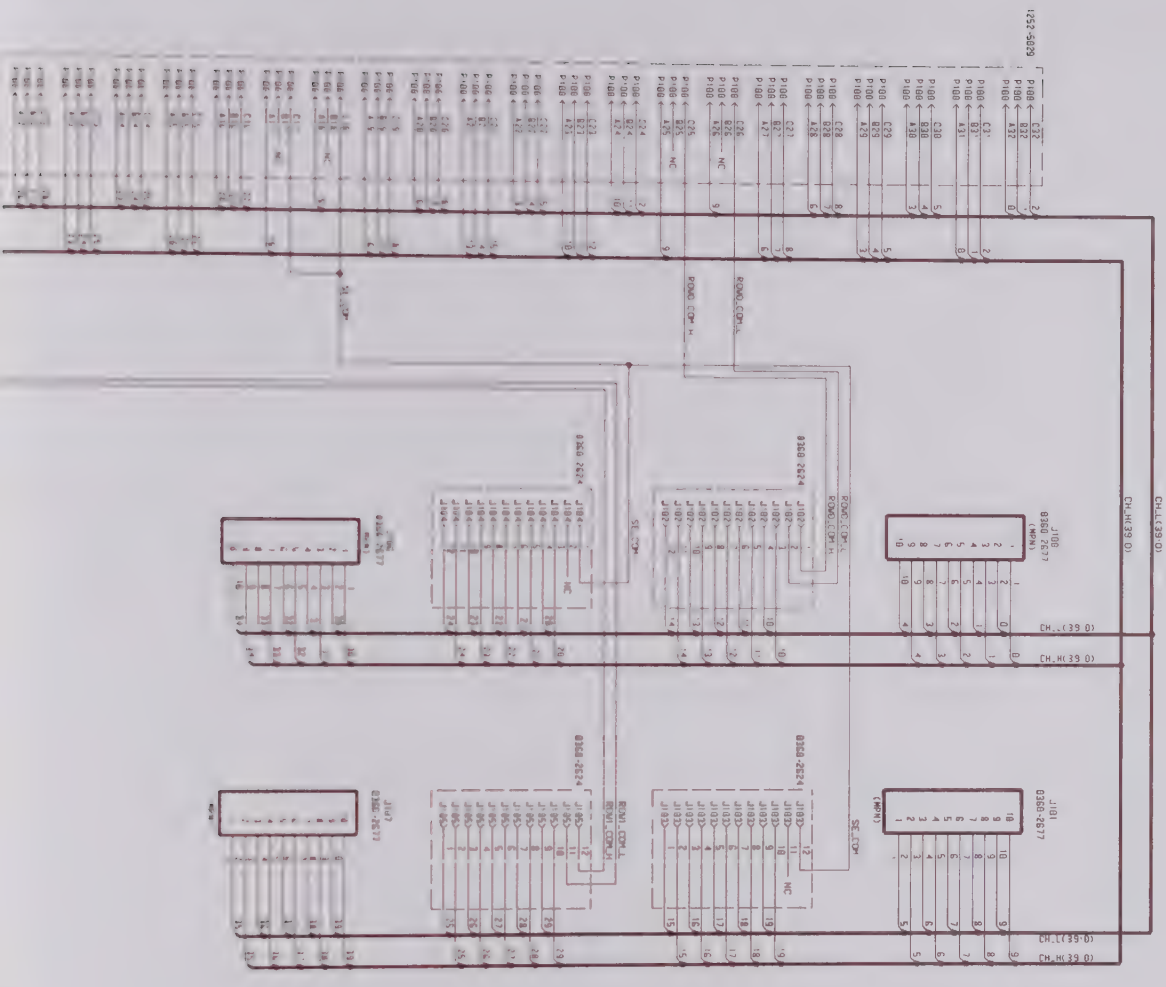
CH28
CH29
CH30
CH31
CH32
CH33
CH34
CH35
CH36
CH37
CH38
CH39



P400
MH401
MH402
C403
L401
C402
U101
C101
C109
U108
C102
C110
R111
C111
L400
C401
C400
C115
R110
C108
U103
C103
R141
R114
R113
U107
C112
R112
C106
U104
C104
R109
R107
R106
R105
U100
C107
U105
C105
C113
R129
R137
R130
CR102
R138
R131
R139
R132
R140
C212
C203
Q222
CR242
C213
C204
Q223
CR243
R133
R125
R126
R134
R127
R135
R128
R136
C210
C201
Q220
CR240
C211
C202
Q221
CR241
CR200 CR201 CR202 CR203 CR204
CR209 CR208 CR207 CR206 CR205
CR210 CR211 CR212 CR213 CR214
CR219 CR218 CR217 CR216 CR215
R230 R220 Q200 Q210 CR244
R210 R200
R231 R221 Q201 Q211 CR245
R211 R201
R232 R222 Q202 Q212 CR246
R212 R202
R233 R223 Q203 Q213 CR247
R213 R203
R234 R224 Q204 Q214 CR248
R214 R204
R235 R225 Q205 Q215 CR249
R215 R205
R236 R226 Q206 Q216 CR250
R216 R206
R237 R227 Q207 Q217 CR251
R217 R207
R238 R228 Q208 Q218 CR252
R218 R208
R239 R229 Q209 Q219 CR253
R219 R209
C205
C206
C207
C208
C209
R157
R156
R155
R154
R153
R152
R151
R150
CR220 CR221 CR222 CR223 CR224
CR229 CR228 CR227 CR226 CR225
CR230 CR231 CR232 CR233 CR234
CR239 CR238 CR237 CR236 CR235
K304
K303
K302
K301
K300
K305
K306
K307
K308
K309
K314
K313
K312
K311
K310
K315
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K325
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K327
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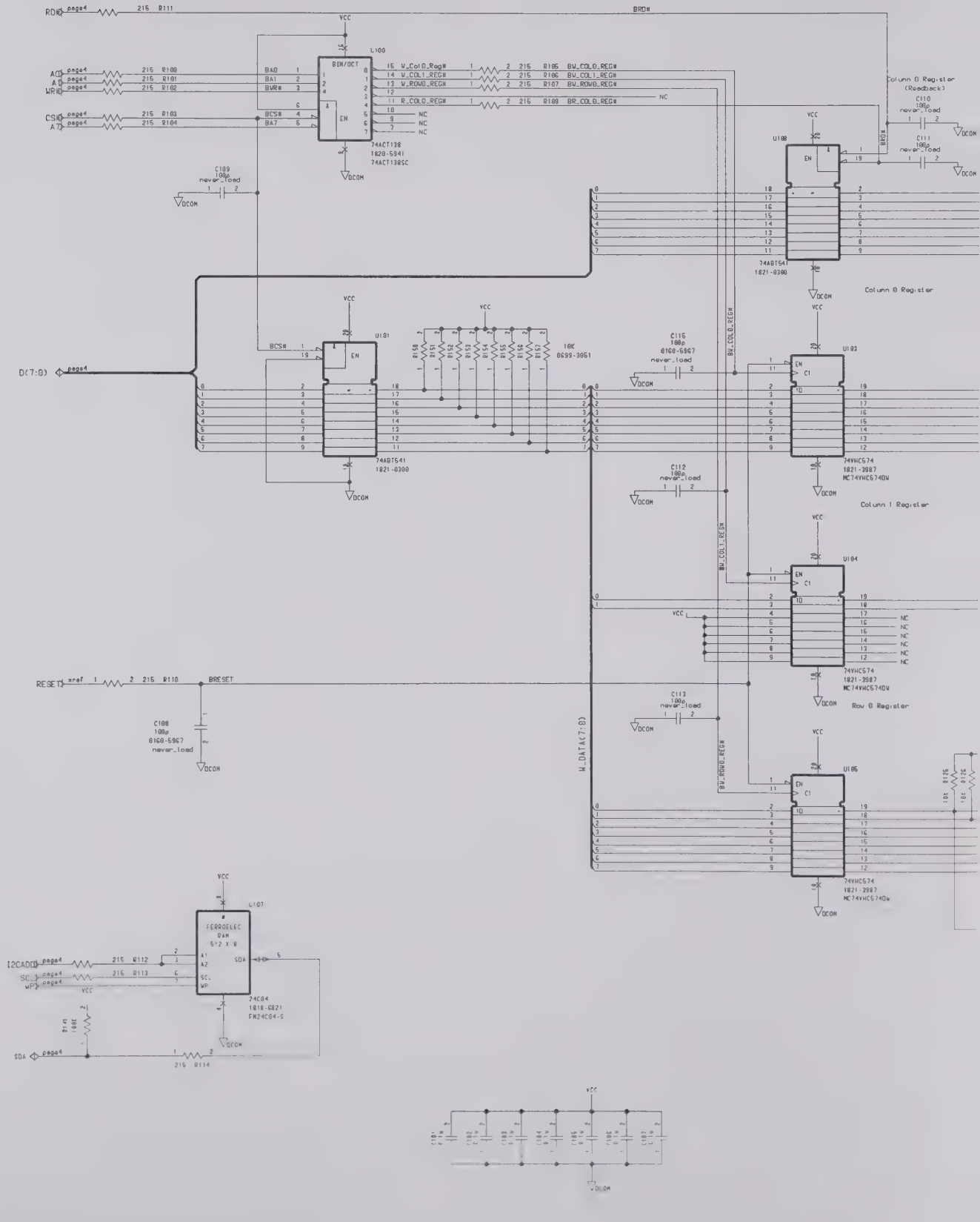
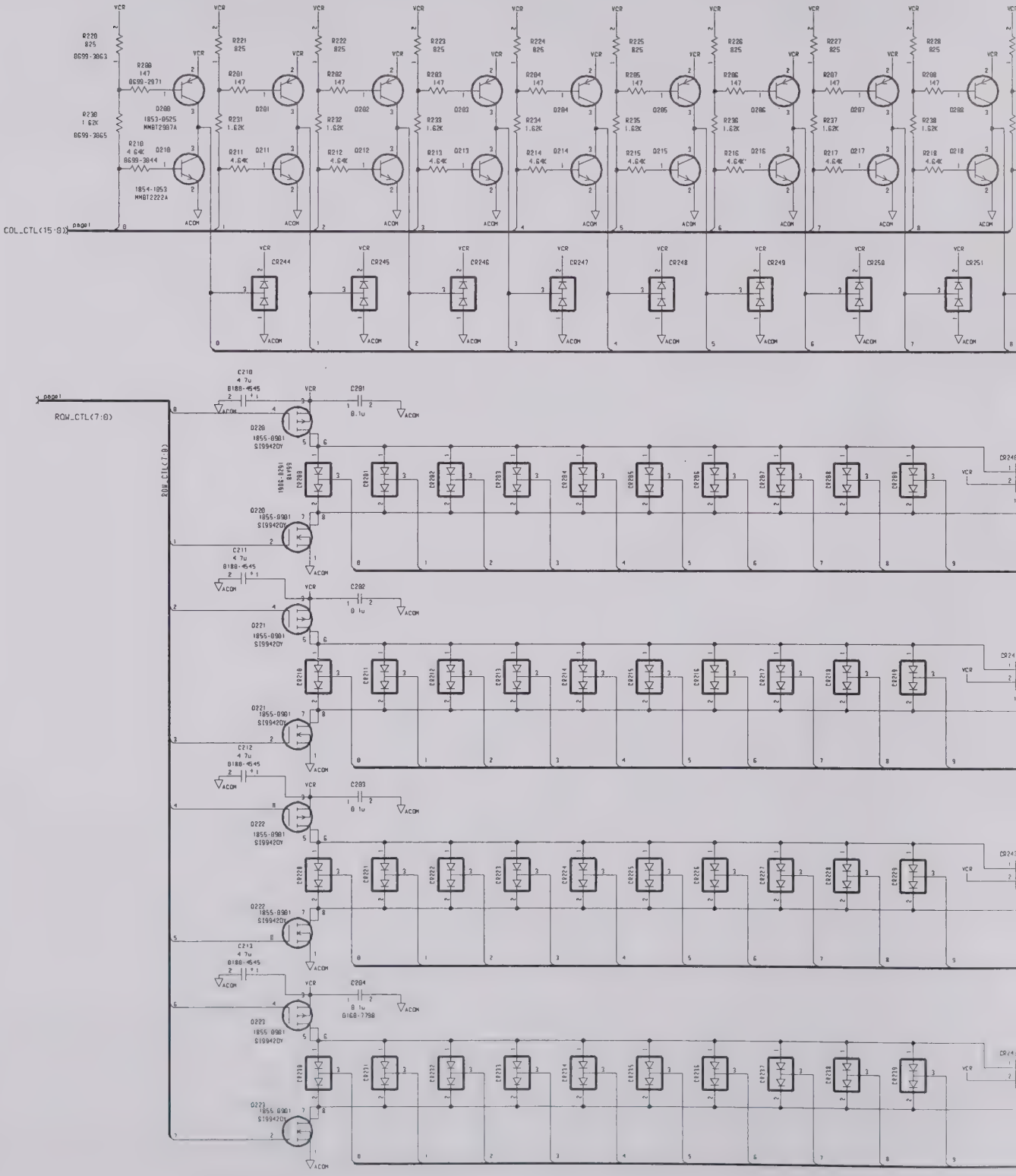
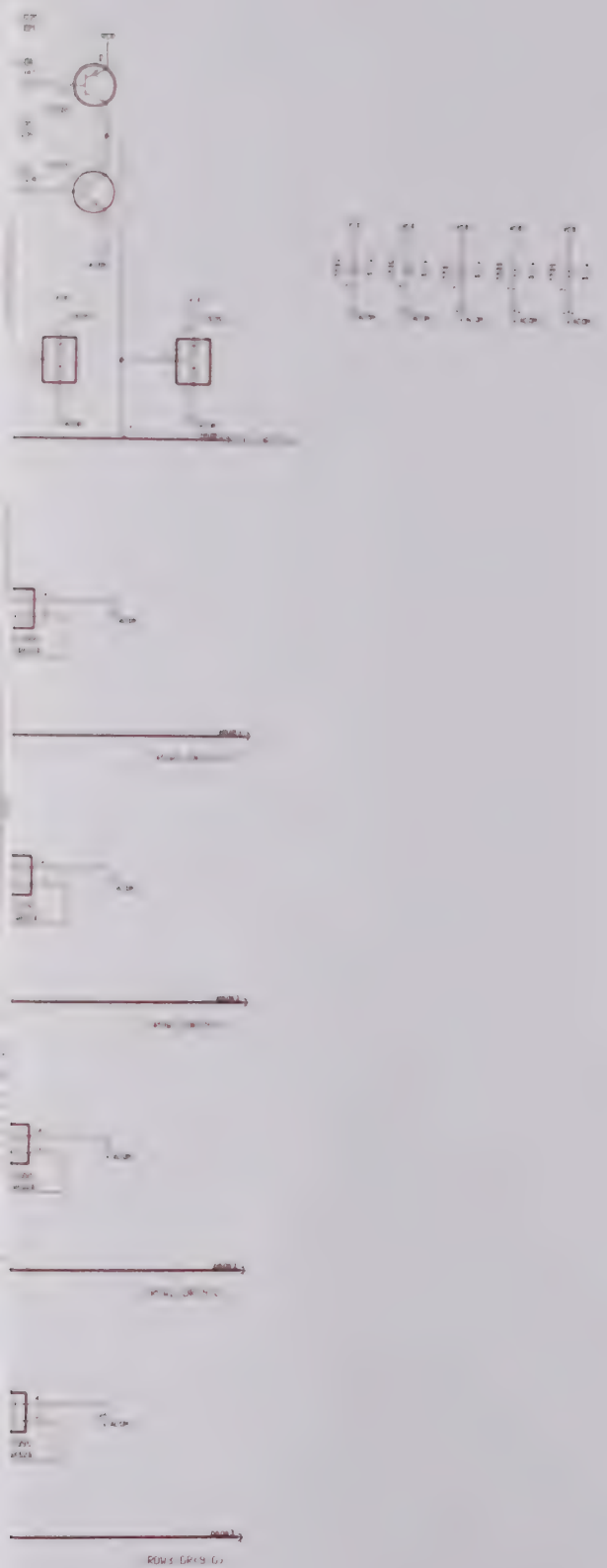
K338
K339

Agilent N2261A GP Relay Module
Components Locator

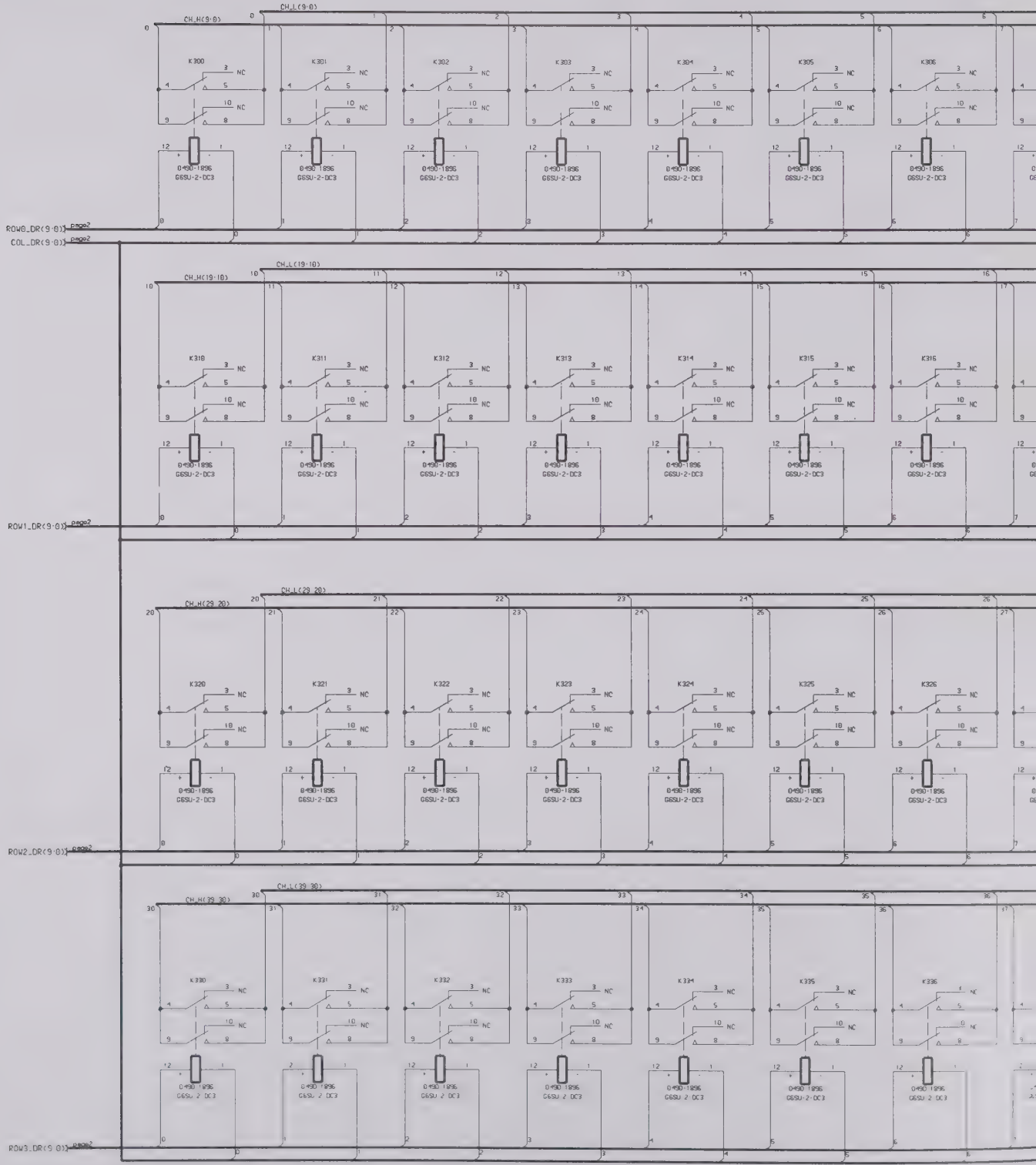

RD#
WR#
CS#
A0
A7
D(7:0)
RESET
I2CADD
SDA
SCL
WP
VCC
DCOM
BRD#
BWR#
BCS#
BA0
BA1
BA7
BRESET
W_DATA(7:0)
BW_COL0_REG#
BW_COL1_REG#
BW_ROW0_REG#
BR_COL0_REG#
W_Col0_Reg#
W_COL1_REG#
W_ROW0_REG#
R_COL0_REG#
Column 0 Register
Column 0 Register (Readback)
Column 1 Register
Row 0 Register
BIM/OCT
74ACT138
74ACT138SC
74ABT541
74VHC574
MC74VHC574DW
FERROELEC RAM
512 X 8
24C04
FM24C04-S
10K
NC
never_load

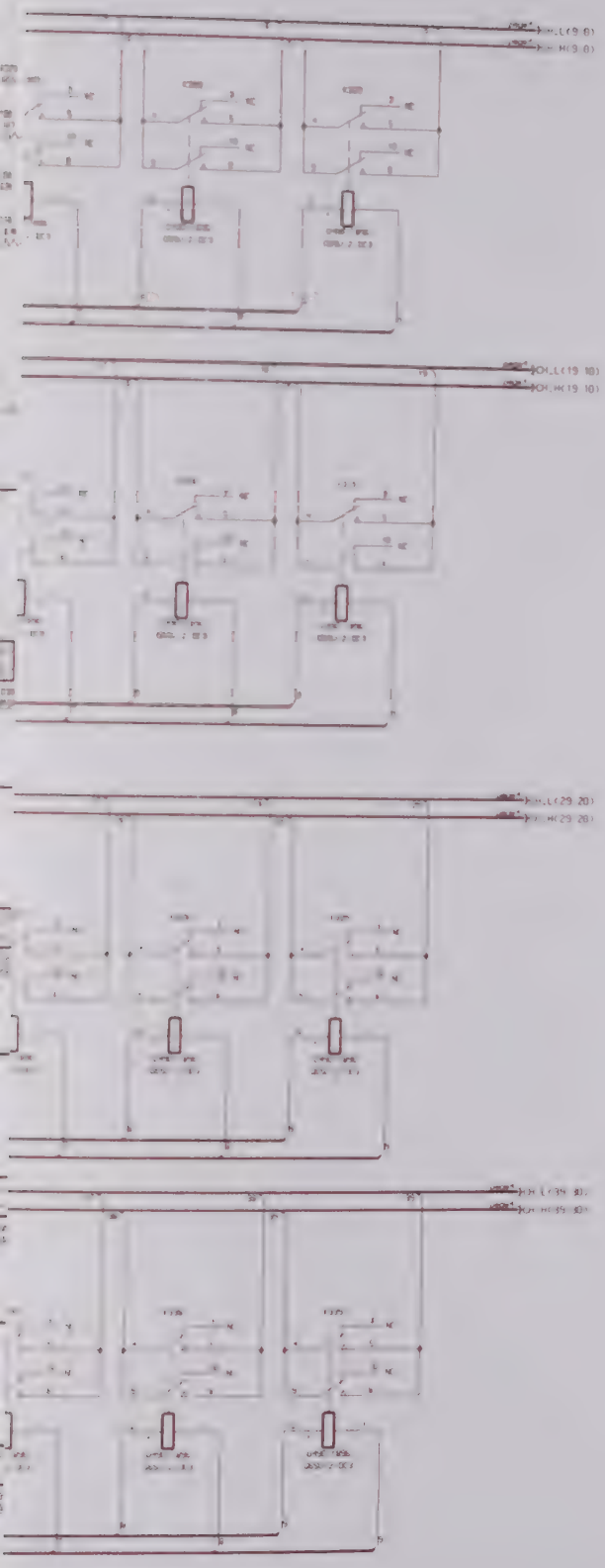
Agilent N2261A GP Relay Module
Schematics -- Sheet 1 of 4


COL_CTL(15:0)
ROW_CTL(7:0)
VCR
ACOM



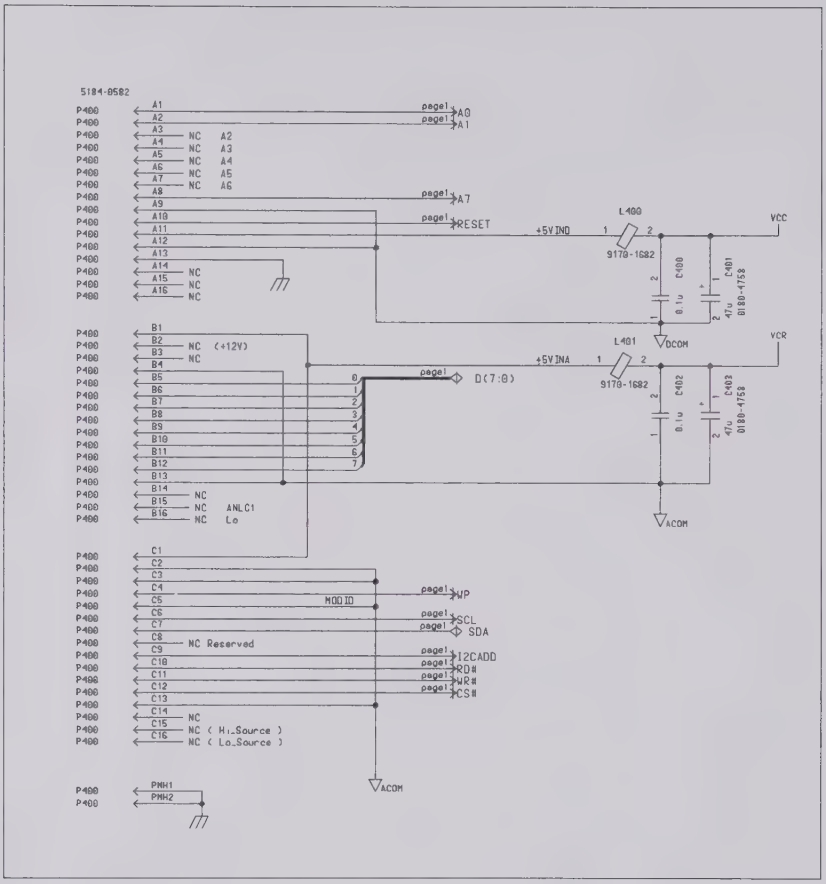
Agilent N2261A GP Relay Module
Schematics -- Sheet 2 of 4


CH_H(9:0)
CH_L(9:0)
K300
K301
K302
K303
K304
K305
K306
0490-1896
GGSU-2-DC3
ROW0_DR(9:0)
COL_DR(9:0)
CH_H(19:10)
CH_L(19:10)
K310
K311
K312
K313
K314
K315
K316
ROW1_DR(9:0)
CH_H(29:20)
CH_L(29:20)
K320
K321
K322
K323
K324
K325
K326
ROW2_DR(9:0)
CH_H(39:30)
CH_L(39:30)
K330
K331
K332
K333
K334
K335
K336
ROW3_DR(9:0)
NC
page2

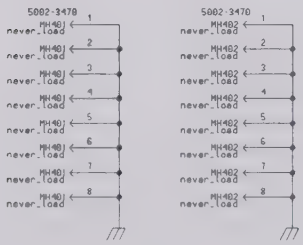


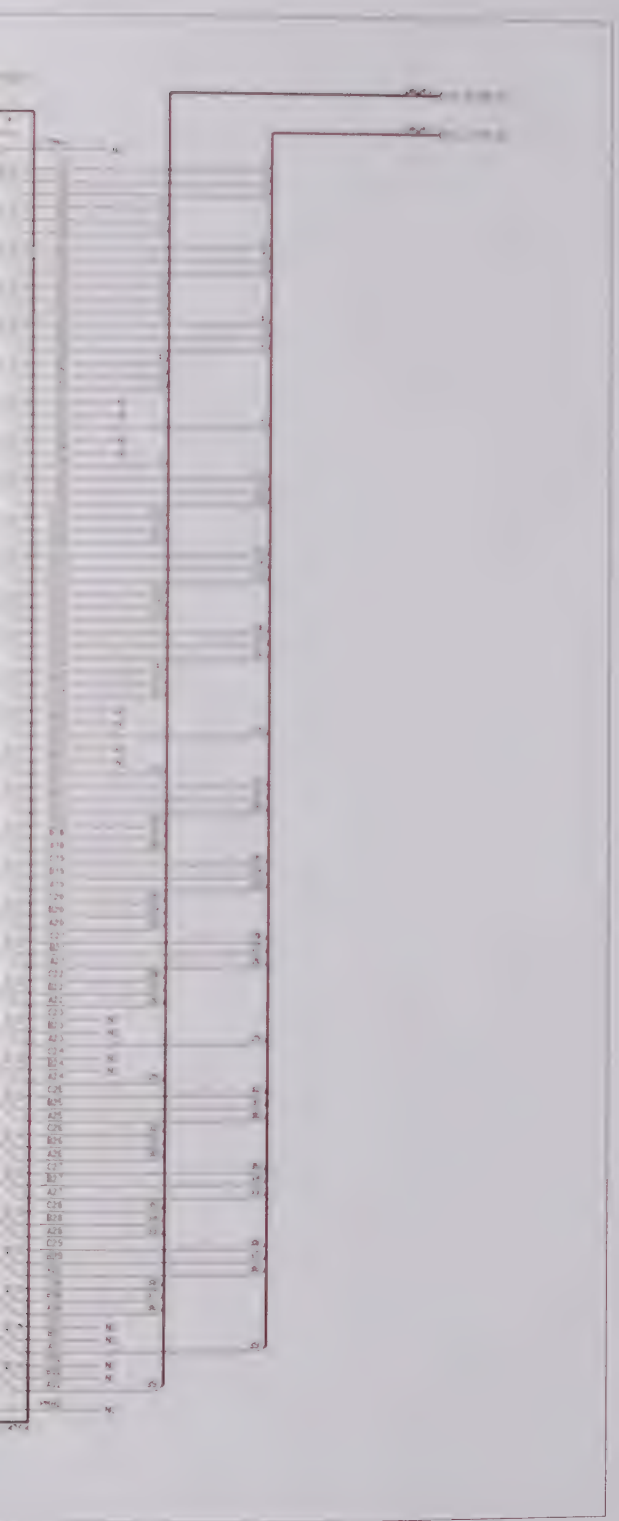
Agilent N2261A GP Relay Module
Schematics -- Sheet 3 of 4

Backplane Connector

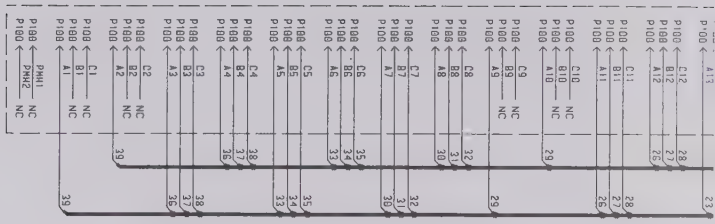


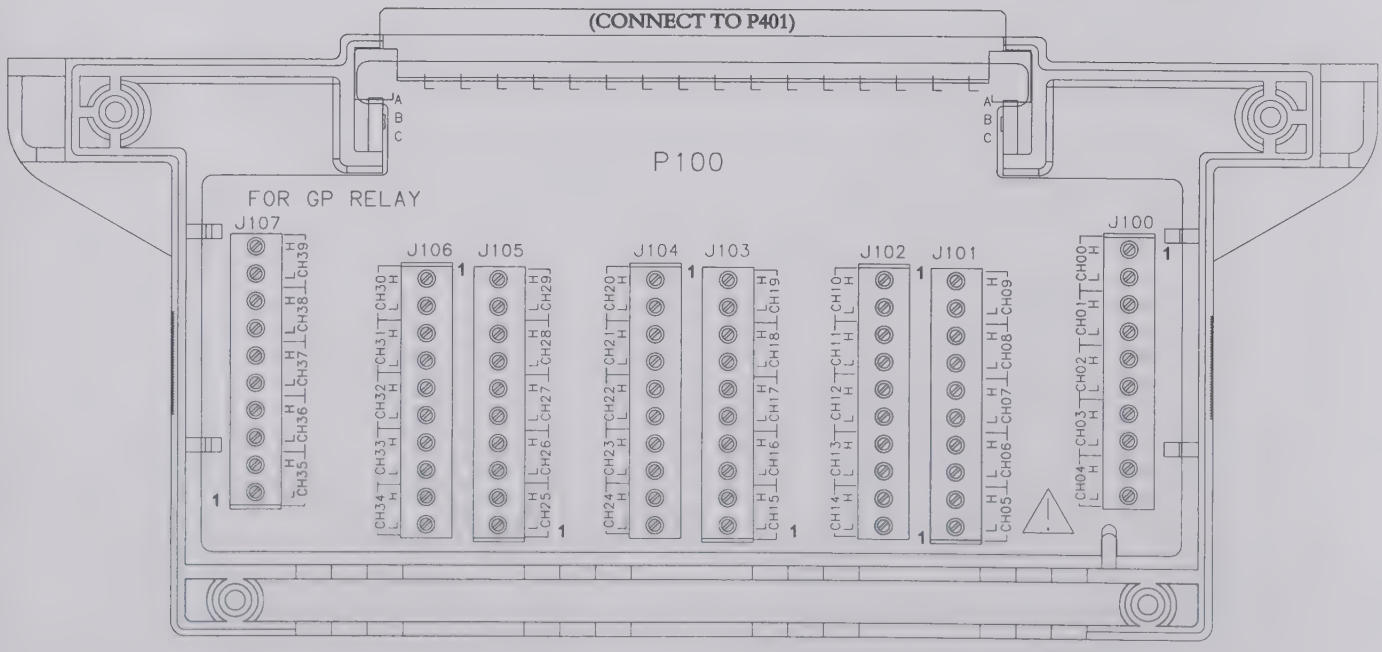
Two Mounting Holes

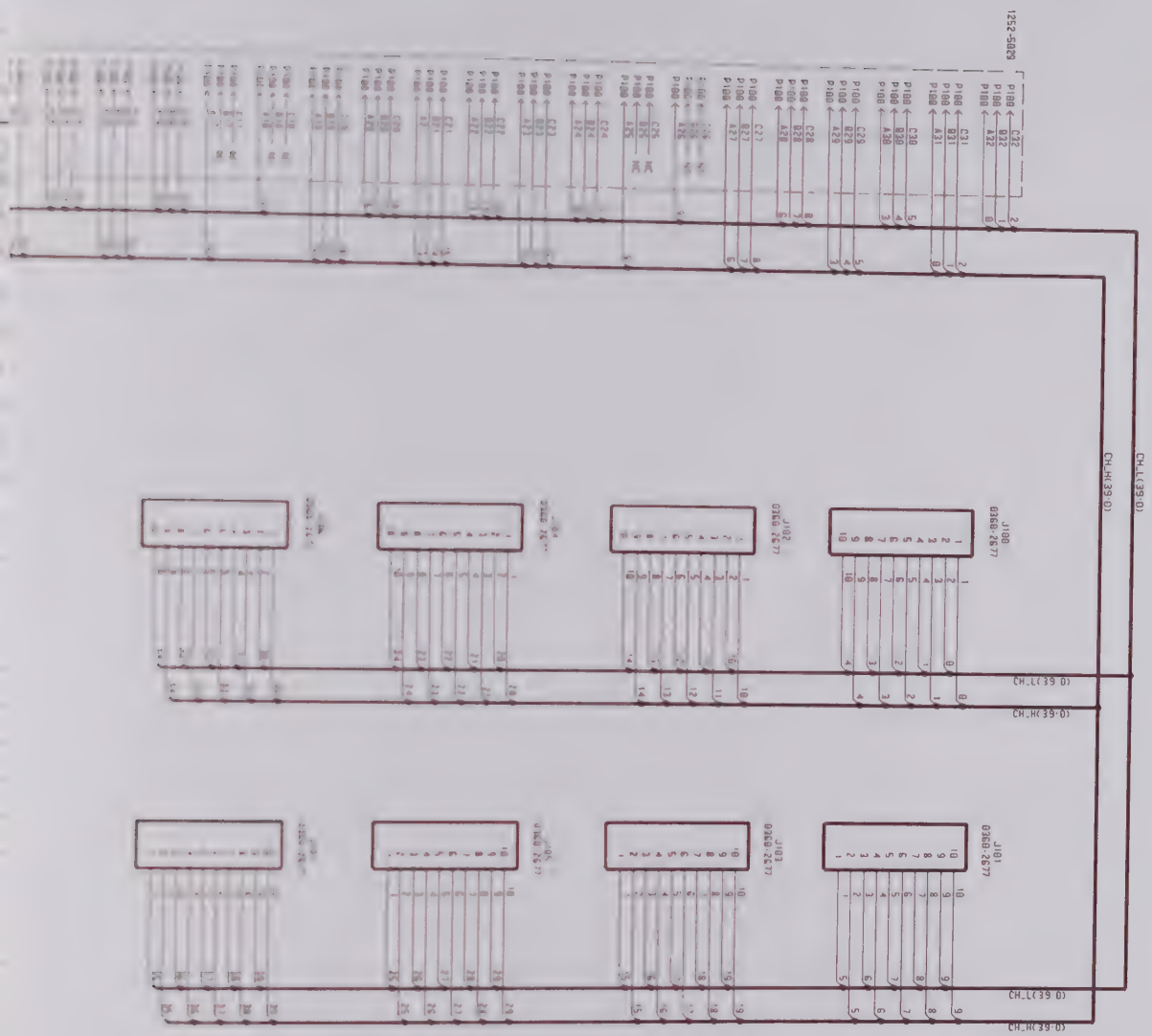




Agilent N2261A GP Relay Module
Schematics -- Sheet 4 of 4




(CONNECT TO P401)
P100
FOR GP RELAY
J107
J106
J105
J104
J103
J102
J101
J100

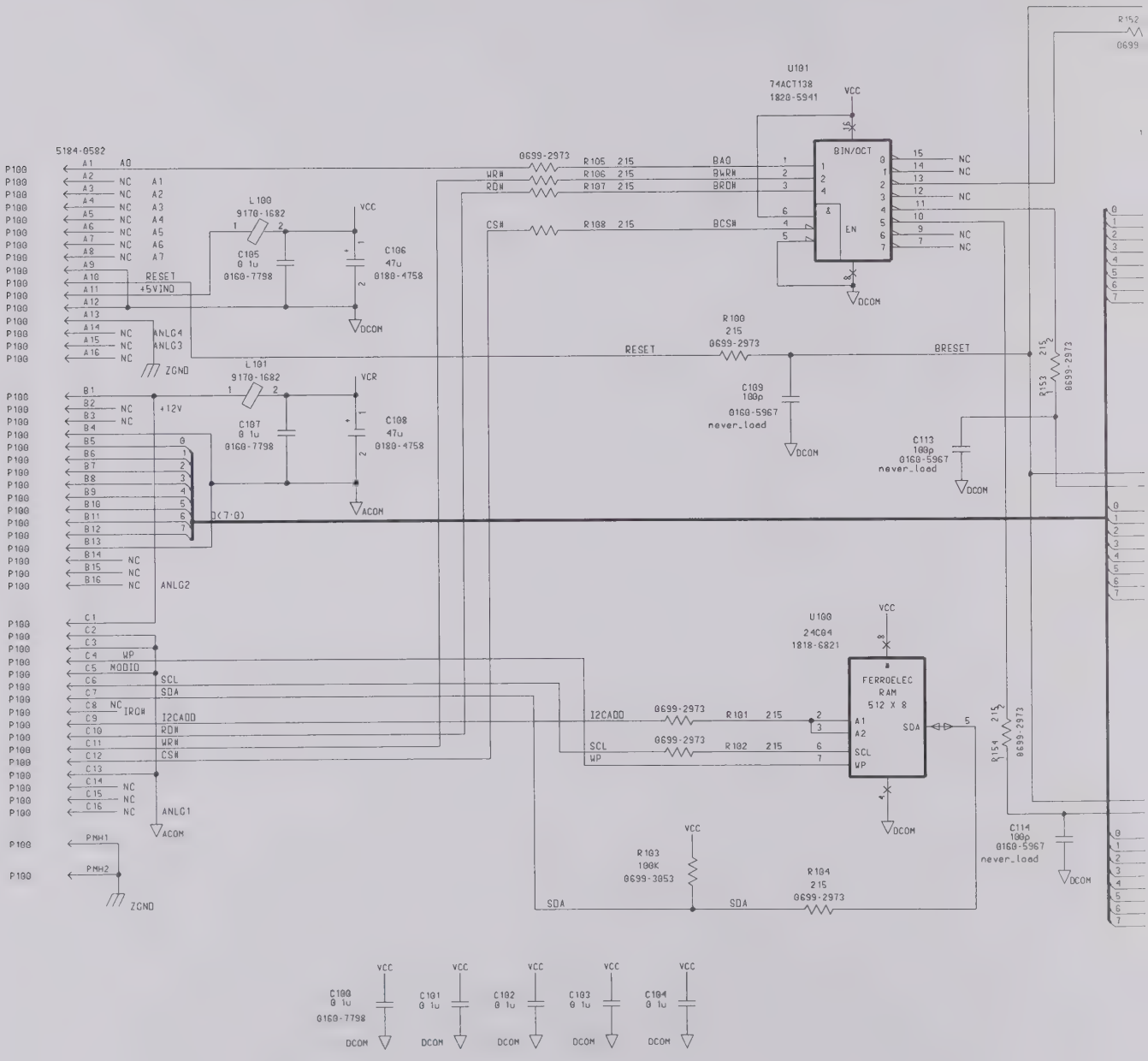


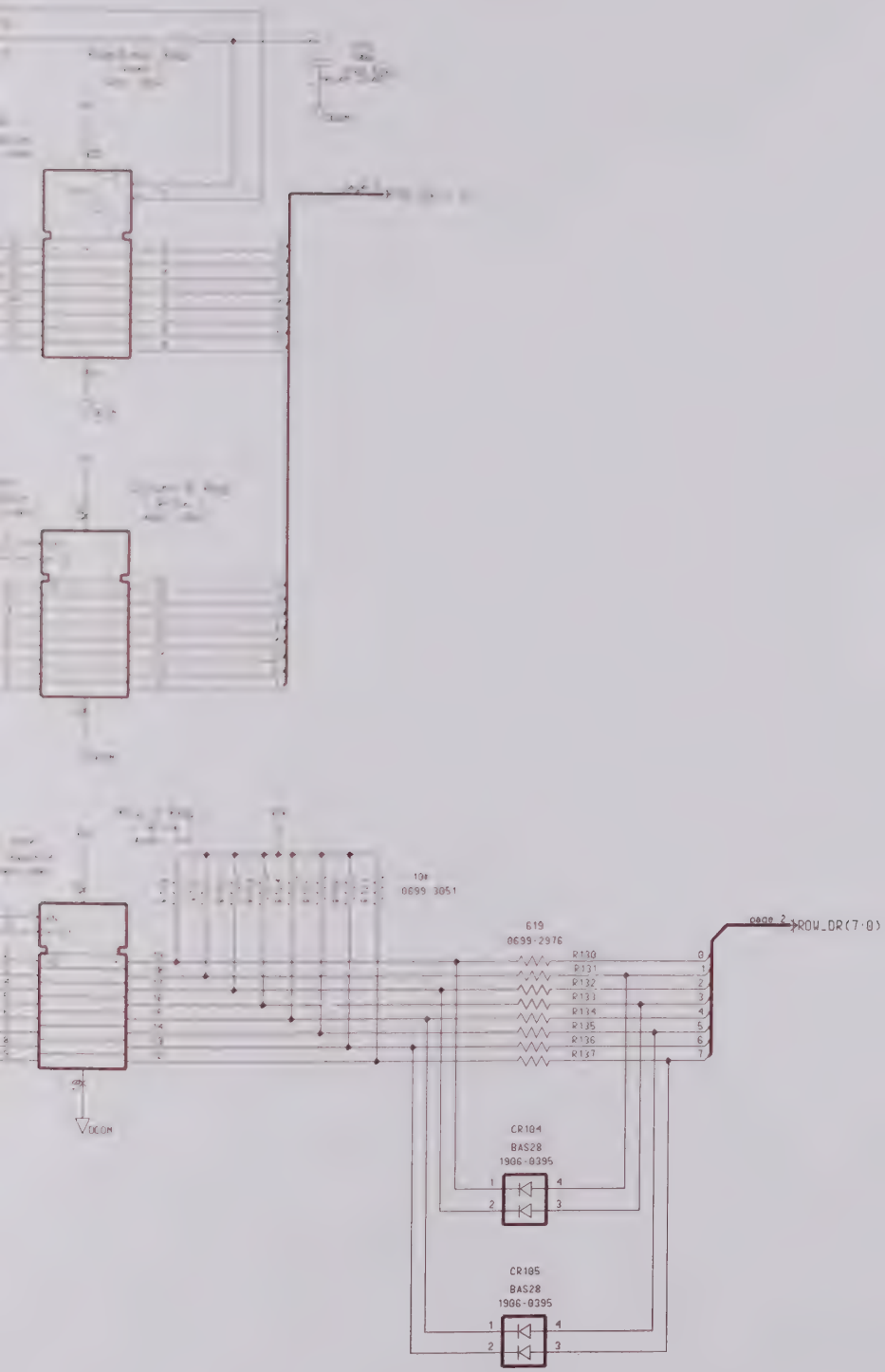
Agilent N2291A Screw Terminal Block Components Locator & Schematics

P100
P301
P302
C105
L100
R100
C109
C106
R101
R104
R103
R102
U100
C100
C113
R105
R106
R107
R108
C114
C101
U101
R152
R153
R154
U102
U103
U104
C102
C112
C103
C104
CR104
CR105
R130
R131
R132
R133
R134
R135
R136
R137
R120
R121
R122
R123
R124
R125
R126
R127
C200
C201
C202
C203
C108
L101
C107
R220
R230
R210
R240
C205
C204
C206
C207
Q200
Q201
Q202
Q203
C210
CR240
Q220
Q210
R221
R231
R211
R241
Q221
Q211
CR241
CR208
CR218
CR228
CR238
CR200
CR210
CR220
CR230
CR201
CR211
CR221
CR231
CR202
CR212
CR222
CR232
CR203
CR213
CR223
CR233
CR204
CR214
CR224
CR234
CR205
CR215
CR225
CR235
CR206
CR216
CR226
CR236
CR207
CR217
CR227
CR237
R222
R232
R212
R242
Q222
Q212
CR242
C212
R223
R233
R213
R243
Q223
Q213
CR243
R224
R234
R214
R244
Q224
Q214
CR244
C214
R225
R235
R215
R245
Q225
Q215
CR245
R226
R236
R216
R246
Q226
Q216
CR246
C216
R227
R237
R217
R247
Q227
Q217
CR247
K300
K301
K302
K303
K304
K305
K306
K307
K310
K311
K312
K313
K314
K315
K316
K317
K320
K321
K322
K323
K324
K325
K326
K327

Agilent N2262A 4 x 8 Matrix Module
Components Locator

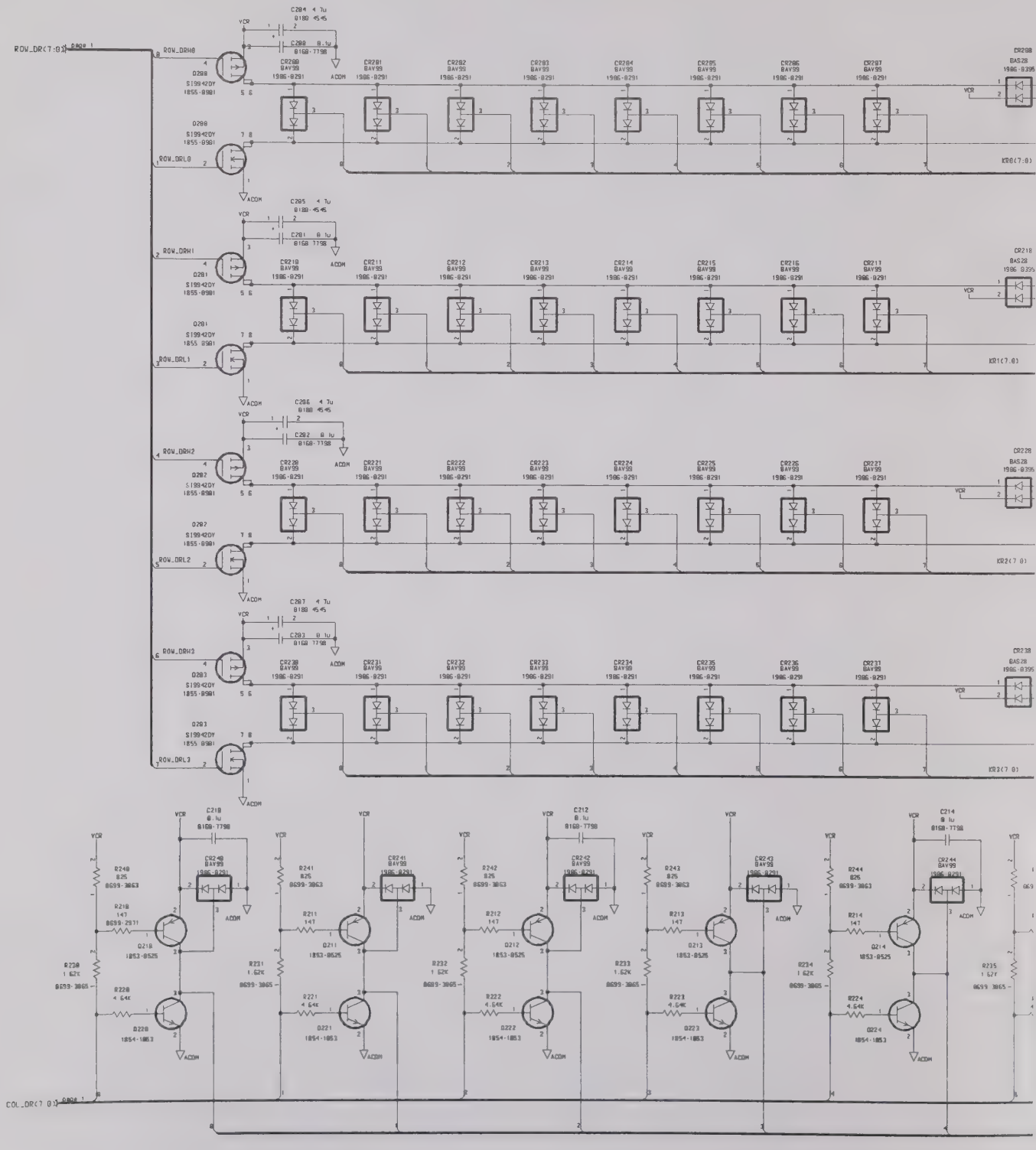
N2262A (Sheet 1) - Control Register

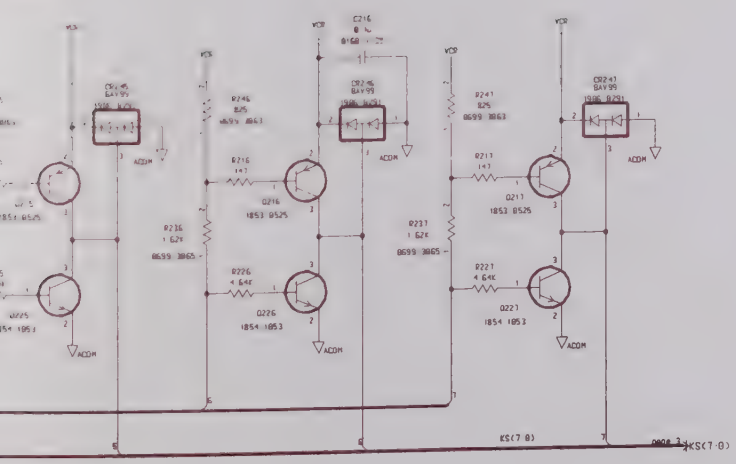




Agilent N2262A 4 x 8 Matrix Module
Schematics -- Sheet 1 of 3

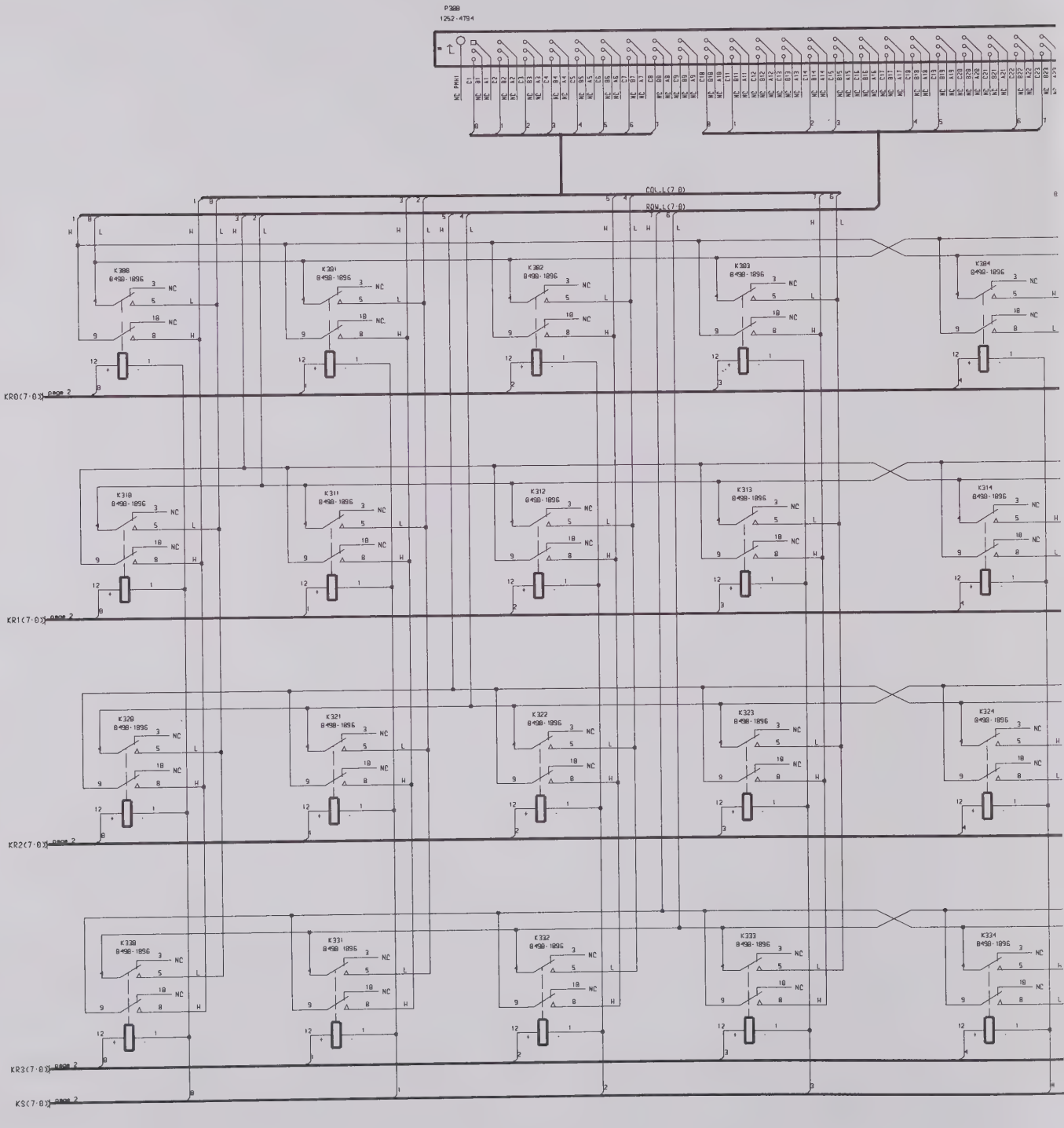
N2262A (Sheet 2) - Row & Column Drivers



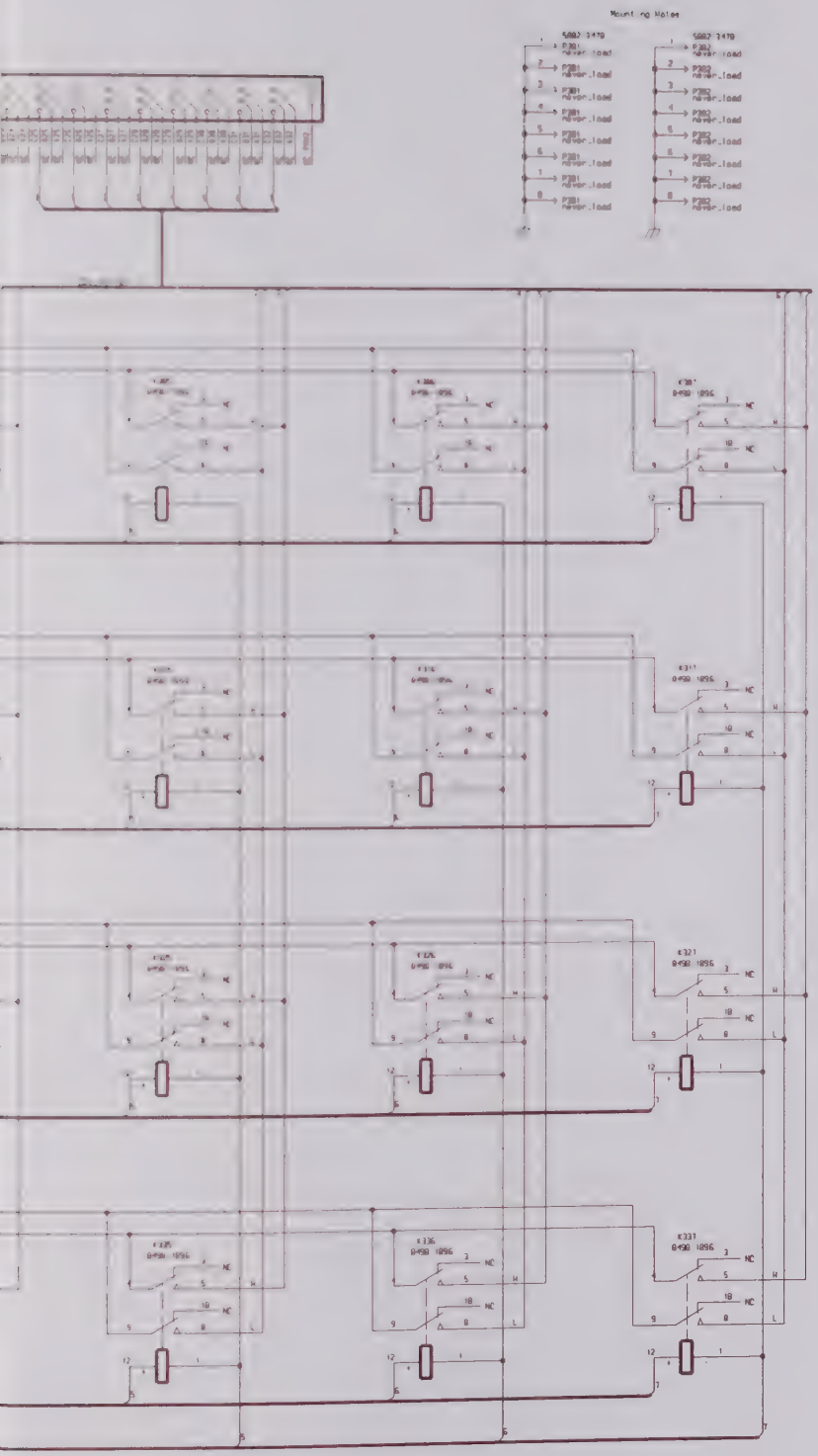


Agilent N2262A 4 x 8 Matrix Module
Schematics -- Sheet 2 of 3

N2262A (Sheet 3) - Relays

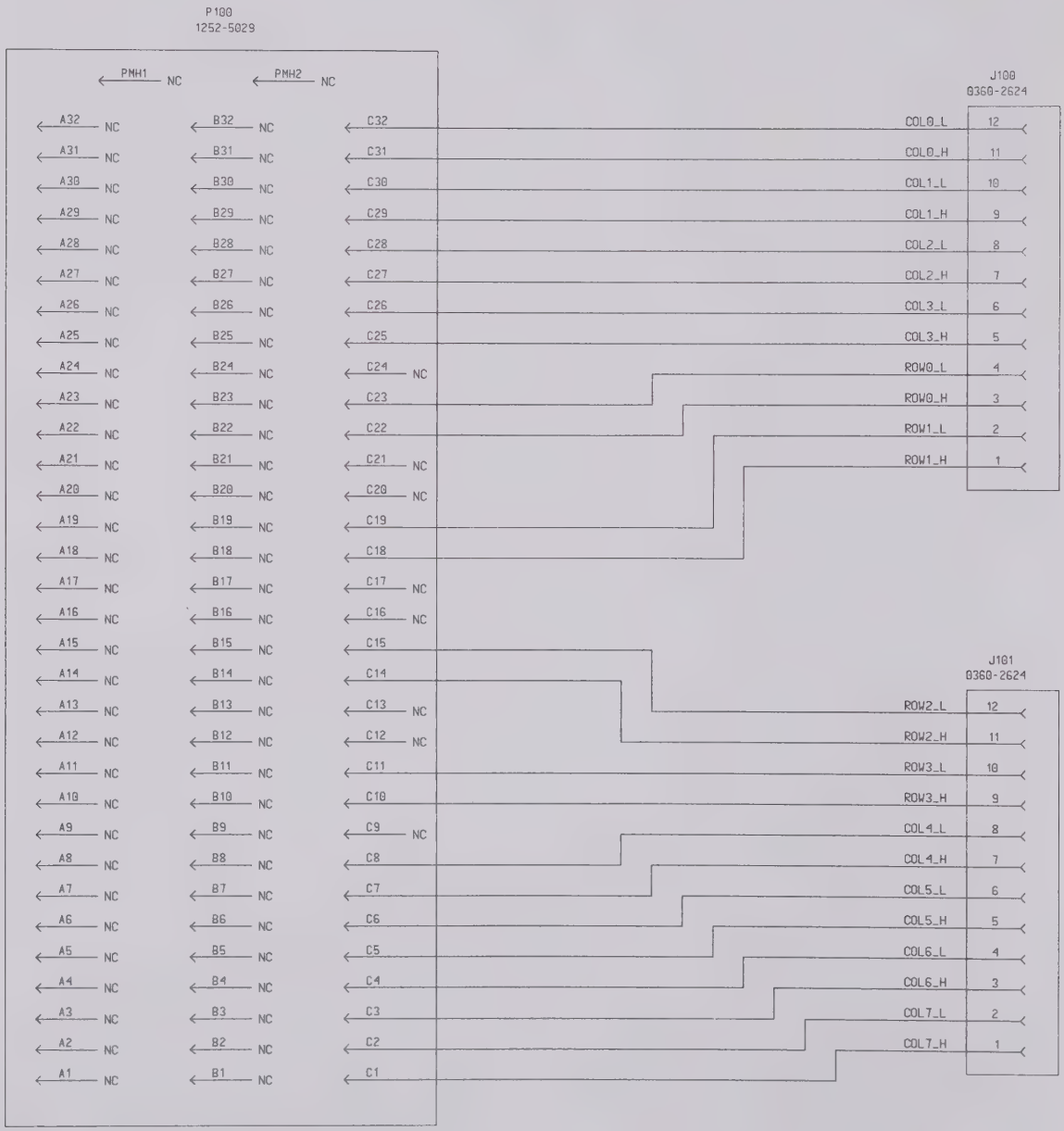


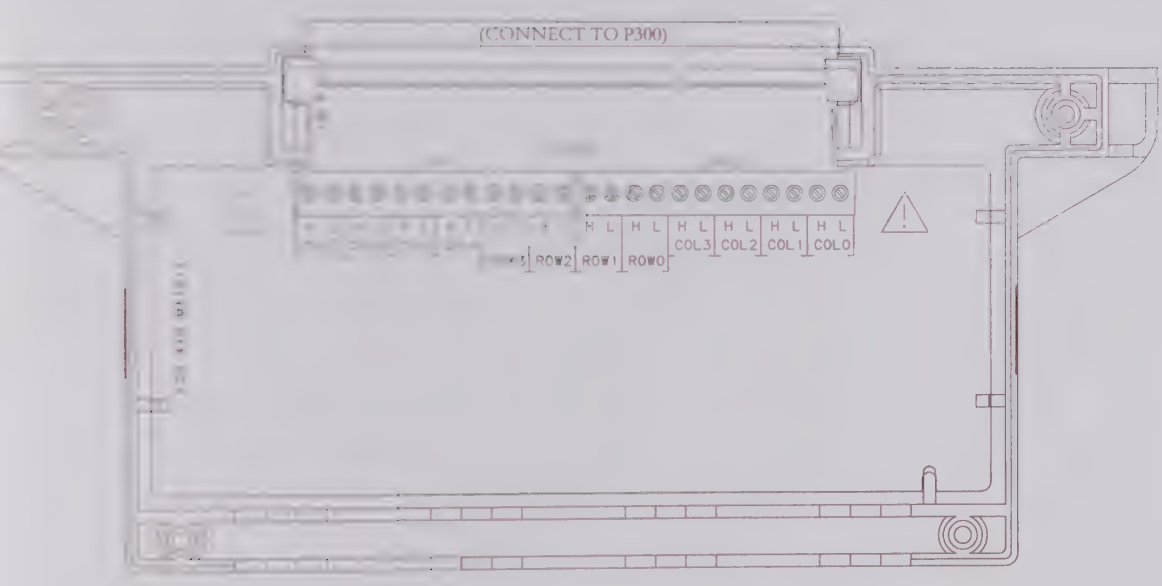
Relay Specification : 1A/200V



Agilent N2262A 4 x 8 Matrix Module
Schematics -- Sheet 3 of 3

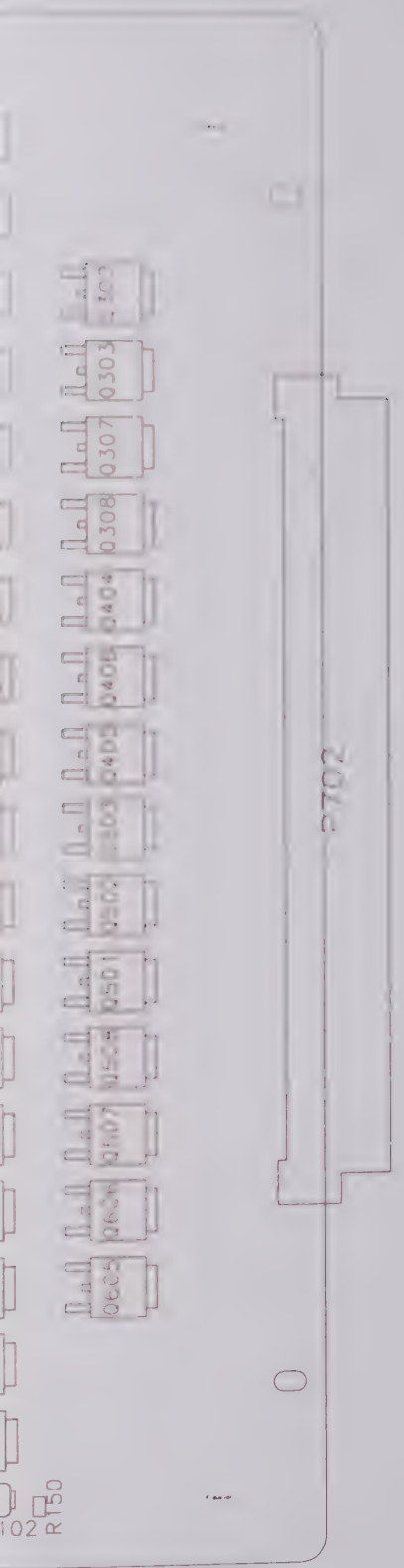
N2292A - N2262A TERMINAL BLOCK



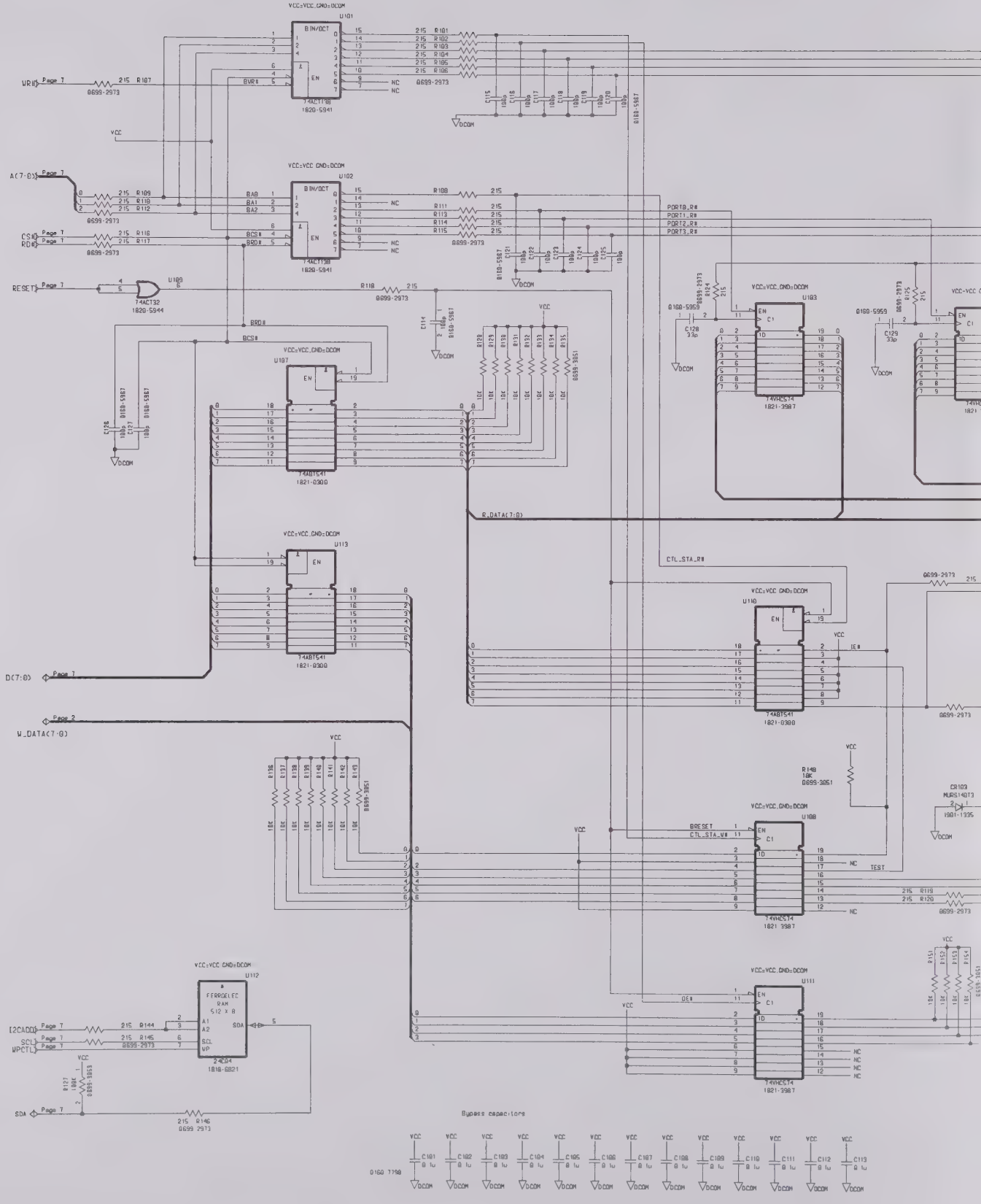


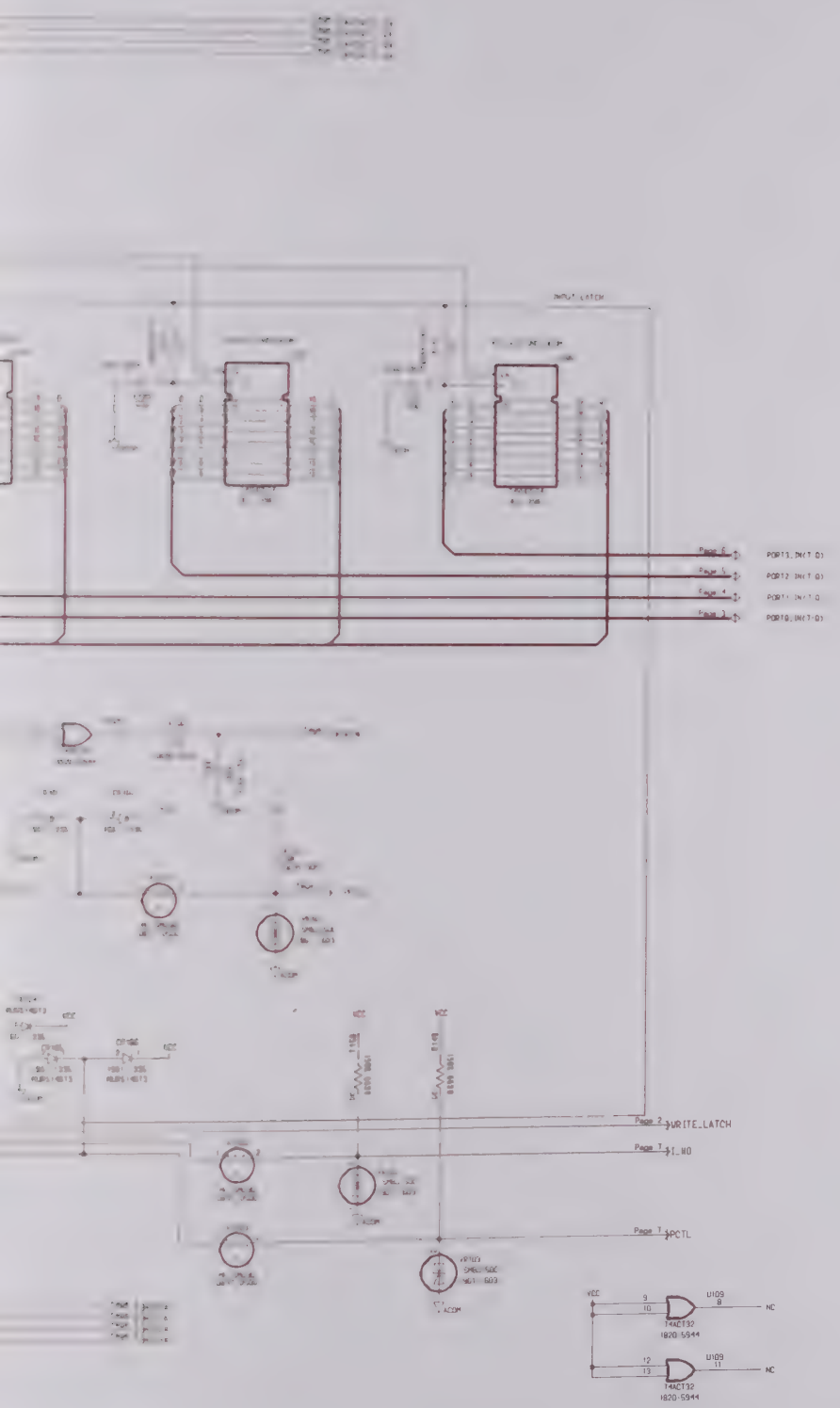
Agilent N2292A Screw Terminal Block
Components Locator & Schematics

P701
U101
U102
U107
U110
U113
U108
U111
U109
U112
U201
U202
U209
U103
U203
U204
U210
U104
U205
U206
U211
U105
U207
U208
U212
U106
U301
U302
U401
U402
U501
U502
U601
U602
C101
C102
C107
C110
C112
C113
C114
C702
C703
C704
R107
R109
R110
R112
R116
C127
C126
R117
L701
C701
R144
R145
R127
R146
R100
C100
R121
R118
R119
R120
R148
C108
R154
R153
R152
R151
C111
CR103
CR105
CR101
CR104
CR106
CR102
R147
C131
C106
R123
R135
R134
R133
R132
R131
R130
R129
R128
R139
R138
R137
R136
R143
R142
R141
R140
C115
C116
C117
C118
C119
C120
C121
C122
C123
C124
C125
C128
C129
C130
C103
C104
C105
R213
R209
R210
R211
R212
C201
C202
C203
C204
C205
C206
C207
C208
C213
C214
C215
C216
R202
R201
R204
R203
R206
R205
R208
R207
RP201
RP202
RP203
RP204
RP205
RP206
RP207
RP208
RP307
RP308
RP301
RP302
RP303
RP304
RP407
RP408
RP401
RP402
RP403
RP404
RP507
RP508
RP501
RP502
RP503
RP504
RP607
RP608
RP601
RP602
RP603
RP604
R318
R317
C302
C301
C303
C209
C217
C210
C218
C211
C219
C212
C220
C214
R124
R125
R126
C402
C401
R402
R401
C501
C502
R502
R501
C602
C601
R602
R601
R301
R304
R302
R305
R303
R306
R307
R401
R308
R402
R404
R403
R406
R408
R405
R407
R503
R506
R502
R505
R501
R504
R508
R603
R507
R602
R606
R601
R605
R608
R604
R607
CR301
CR304
CR302
CR305
CR303
CR306
CR307
CR401
CR308
CR402
CR404
CR403
CR406
CR408
CR405
CR407
CR503
CR506
CR502
CR505
CR501
CR504
CR508
CR603
CR507
CR602
CR606
CR601
CR605
CR608
CR604
CR607
Q301
Q304
Q305
Q306
Q401
Q402
Q403
Q408
Q407
Q506
Q505
Q504
Q603
Q602
Q601
Q608
Q607
Q604
L702
VR101
VR103
RT101
RT103
RT102

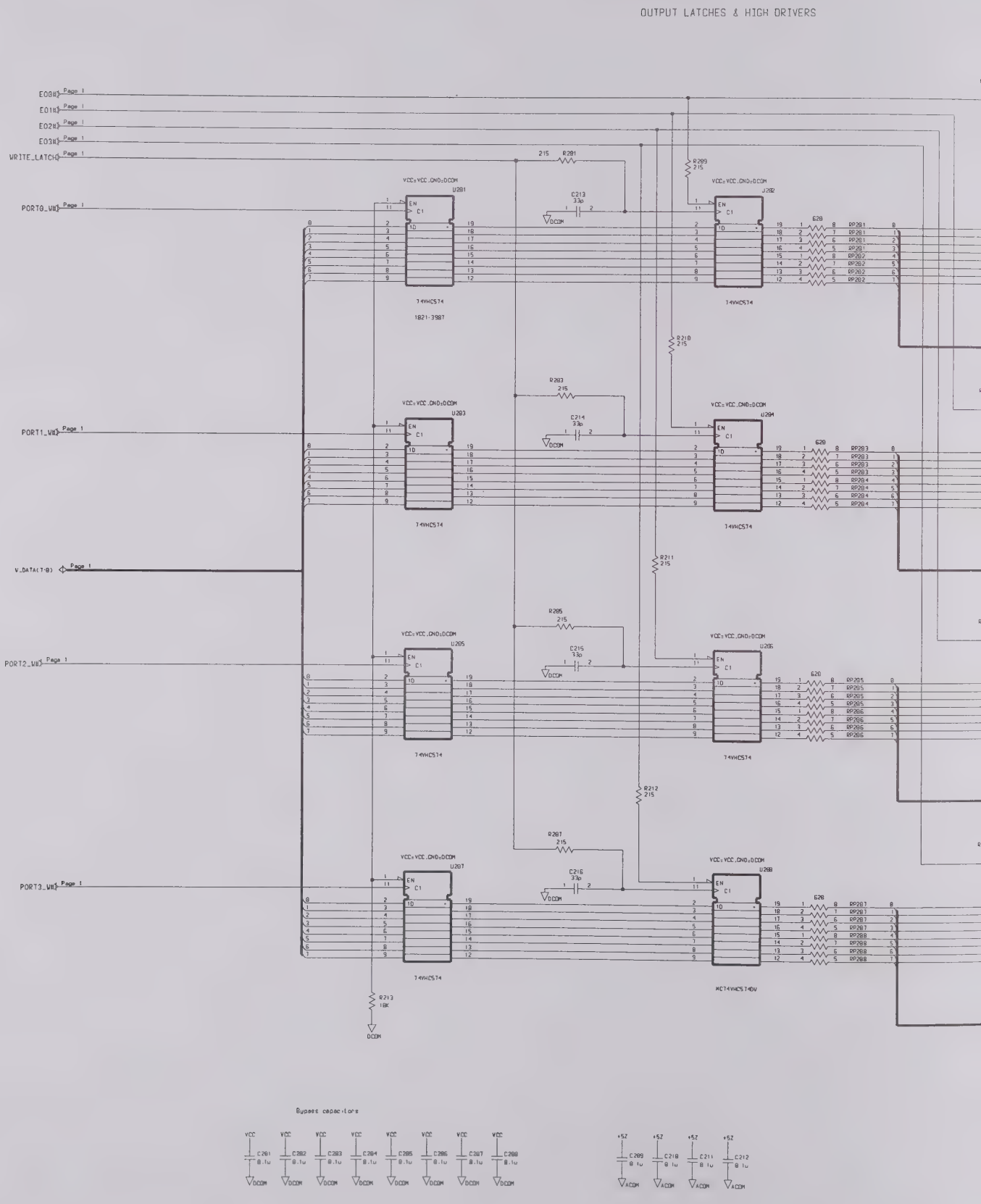


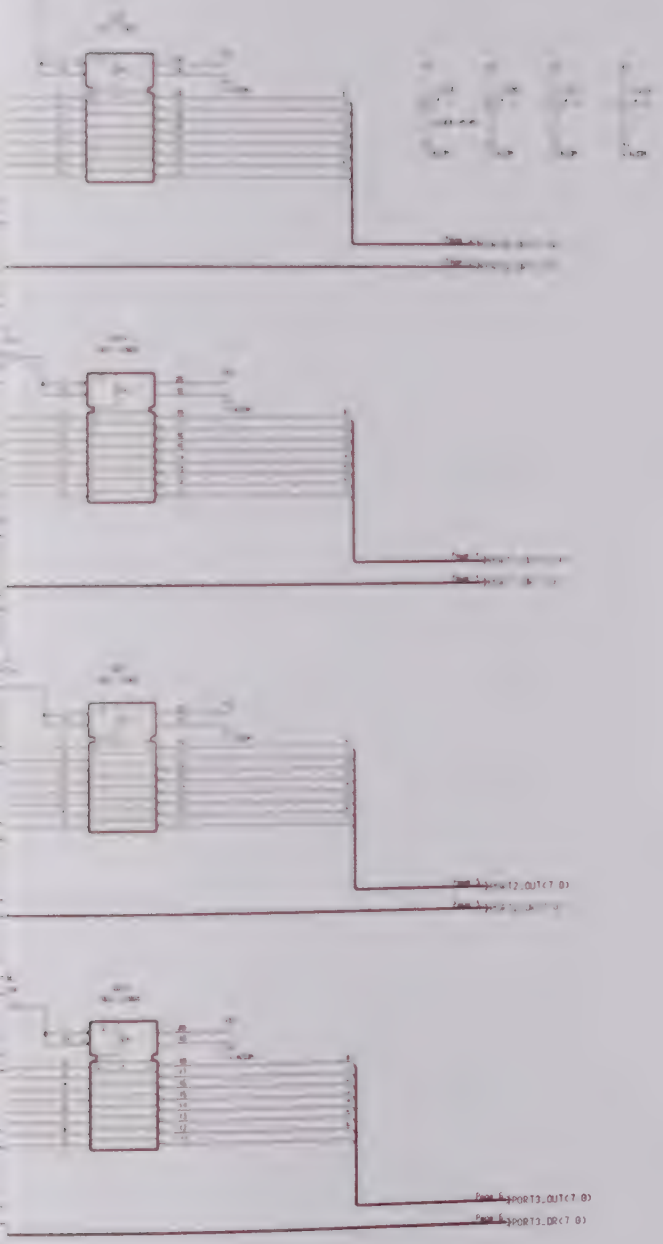
Agilent N2263A 32-Bit Digital I/O Module Components Locator


VCC=VCC_GND=DCOM
U101
BIN/OCT
74ACT138
1820-5941
R101
R102
R103
R104
R105
R106
0699-2973
VR1#
Page 7
R107
VCC
A(7:0)
U102
R109
R110
R112
CS1#
RD#
R116
R117
RESET
U109
74ACT32
1820-5944
R118
BRD#
BCS#
U107
74ABT541
1821-0300
R120
R130
R131
R132
R133
R134
R135
0699-3951
C125
C126
C127
0160-5967
DCOM
C114
C115
C116
C117
C118
C119
C120
C121
C122
C123
C124
PORT0_R#
PORT1_R#
PORT2_R#
PORT3_R#
U103
74VHCS74
1821-3987
C128
C129
0160-5959
R_DATA(7:0)
CTL_STA_R#
U116
IE#
D(7:0)
Page 2
W_DATA(7:0)
R136
R137
R138
R139
R140
R141
R142
R143
U108
BRESET
CTL_STA_W#
TEST
R148
CR103
MURS140T3
1901-1335
R119
R120
U111
OE#
R151
R152
R153
R154
R155
U112
FERROELEC
RAM
512 X 8
24C04
1818-6821
I2CADD
SCL
WPCTL
SDA
R144
R145
R146
R147
Bypass capacitors
C101
C102
C103
C104
C105
C106
C107
C108
C109
C110
C111
C112
C113
0160 7798

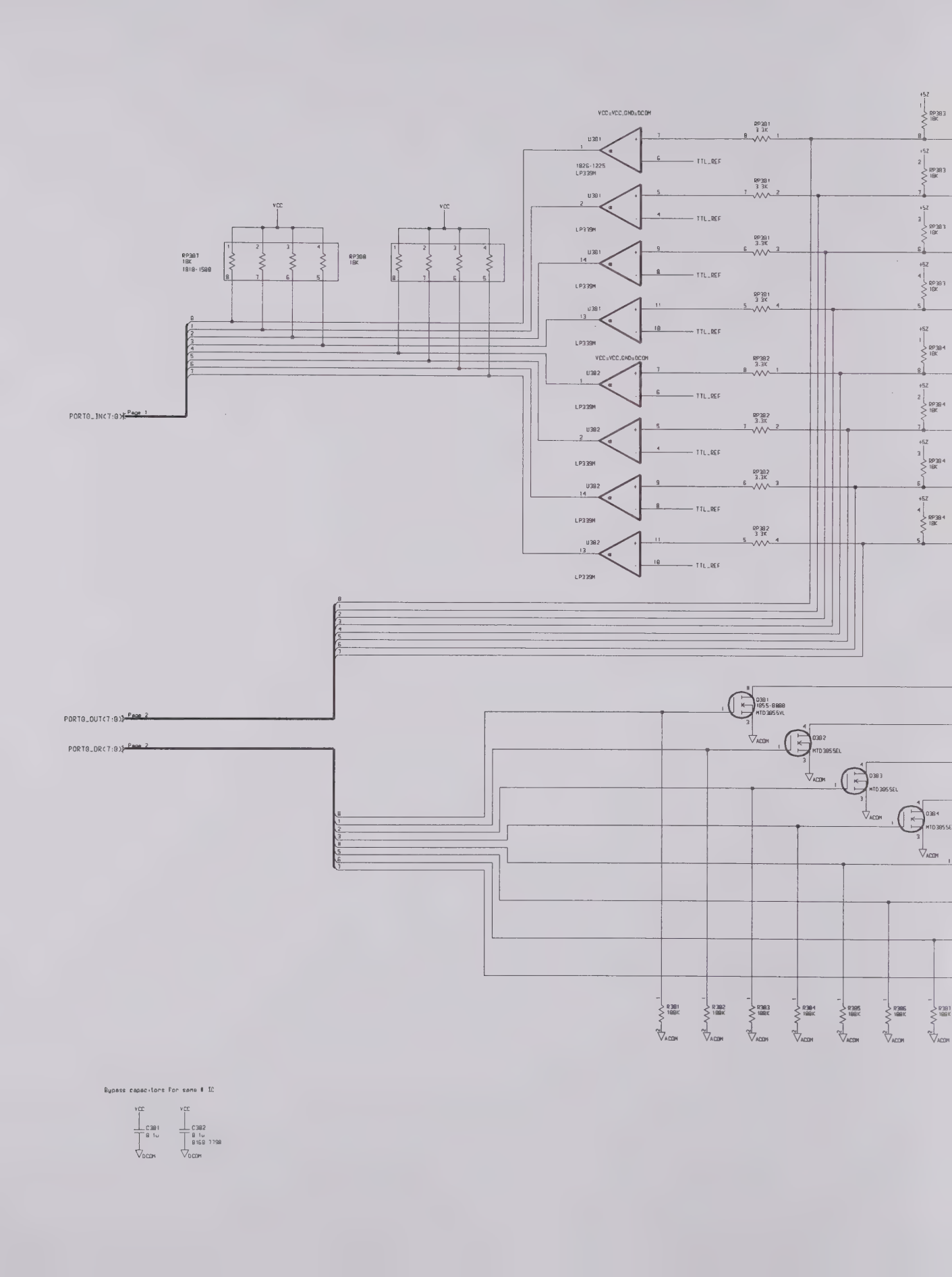


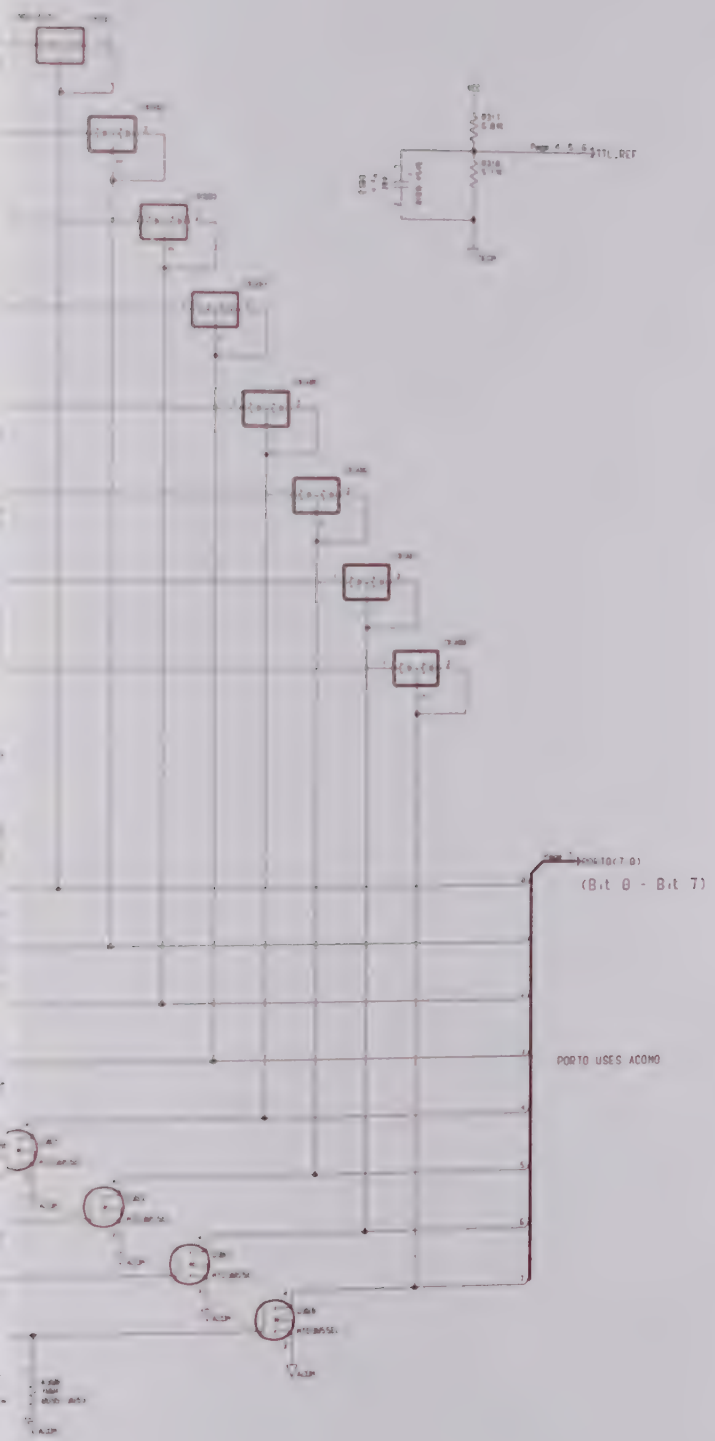
Agilent N2263A 32-Bit Digital I/O Module
Schematics -- Sheet 1 of 7


OUTPUT LATCHES & HIGH DRIVERS
EO0(8)
EO1(8)
EO2(8)
EO3(8)
WRITE_LATCH
PORT0_WR
PORT1_WR
V_DATA(7:0)
PORT2_WR
PORT3_WR
Page 1
R201 215
R209 215
R210 215
R203 215
R211 215
R205 215
R212 215
R207 215
R213 18K
C213 33p
C214 33p
C215 33p
C216 33p
U201
U202
U203
U204
U205
U206
U207
U208
74VHC574
1821-3987
MC74VHC540V
RP201
RP202
RP203
RP204
RP205
RP206
RP207
RP208
620
VCC=VCC_CND=DCOM
DCOM
Bypass capacitors
C201 0.1u
C202 0.1u
C203 0.1u
C204 0.1u
C205 0.1u
C206 0.1u
C207 0.1u
C208 0.1u
+5Z
C209 0.1u
C210 0.1u
C211 0.1u
C212 0.1u
ACOM

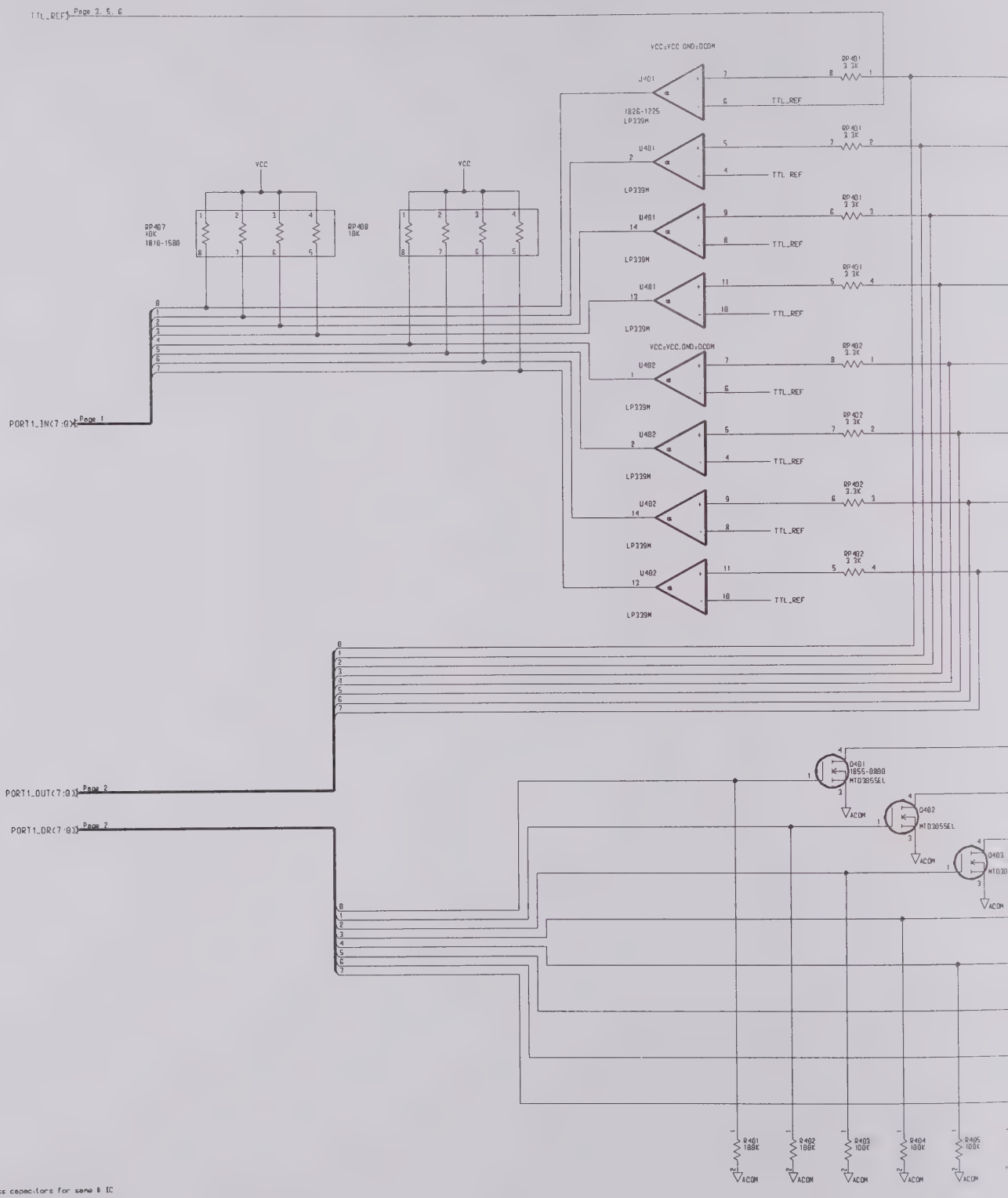


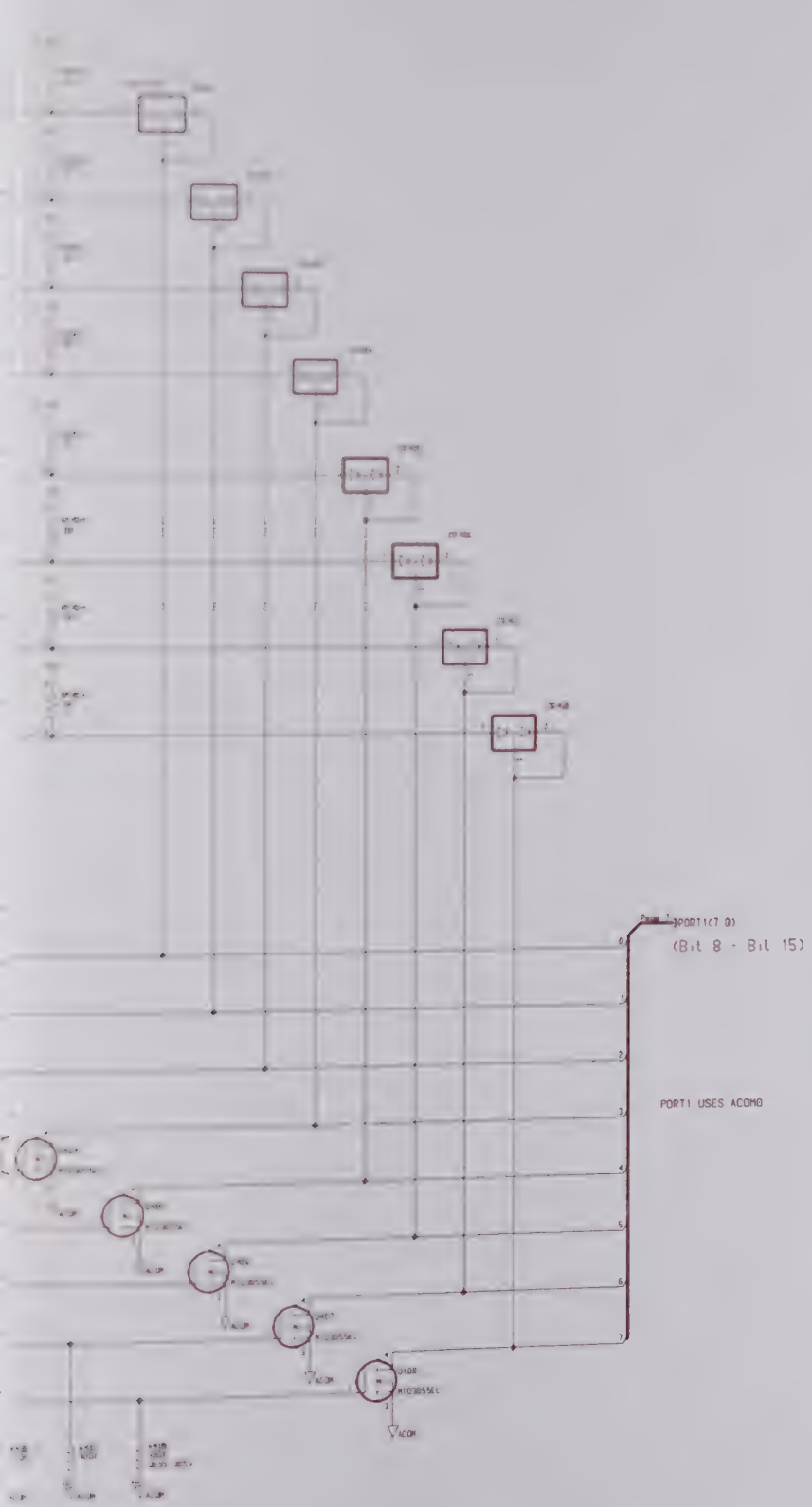
Agilent N2263A 32-Bit Digital I/O Module
Schematics -- Sheet 2 of 7


PORTB_IN<7:0>
Page 1
PORTB_OUT<7:0>
Page 2
PORTB_DR<7:0>
Page 2
VCC=VCC,GND=DCOM
U381
1826-1225
LP339M
U382
TTL_REF
RP381
3.3K
RP382
3.3K
RP383
10K
RP384
10K
RP387
10K
1818-1500
RP388
10K
VCC
+5Z
D381
1955-0888
MTD3055VL
D382
MTD3055EL
D383
MTD3055EL
D384
MTD3055E
ACOM
R381
100K
R382
100K
R383
100K
R384
100K
R385
100K
R386
100K
R387
100K
Bypass capacitors for same 8 IC
C381
.1u
C382
.1u
DCOM

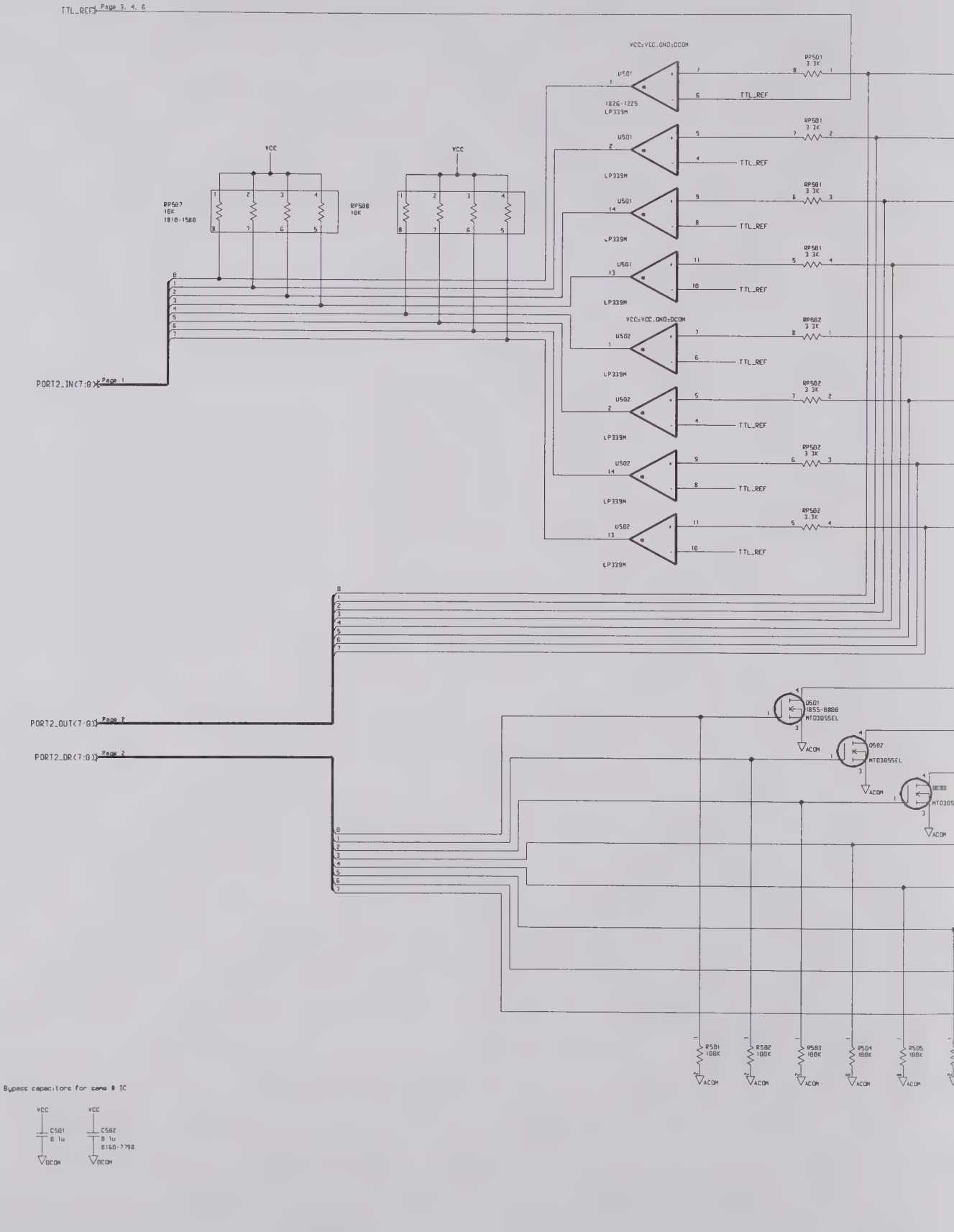


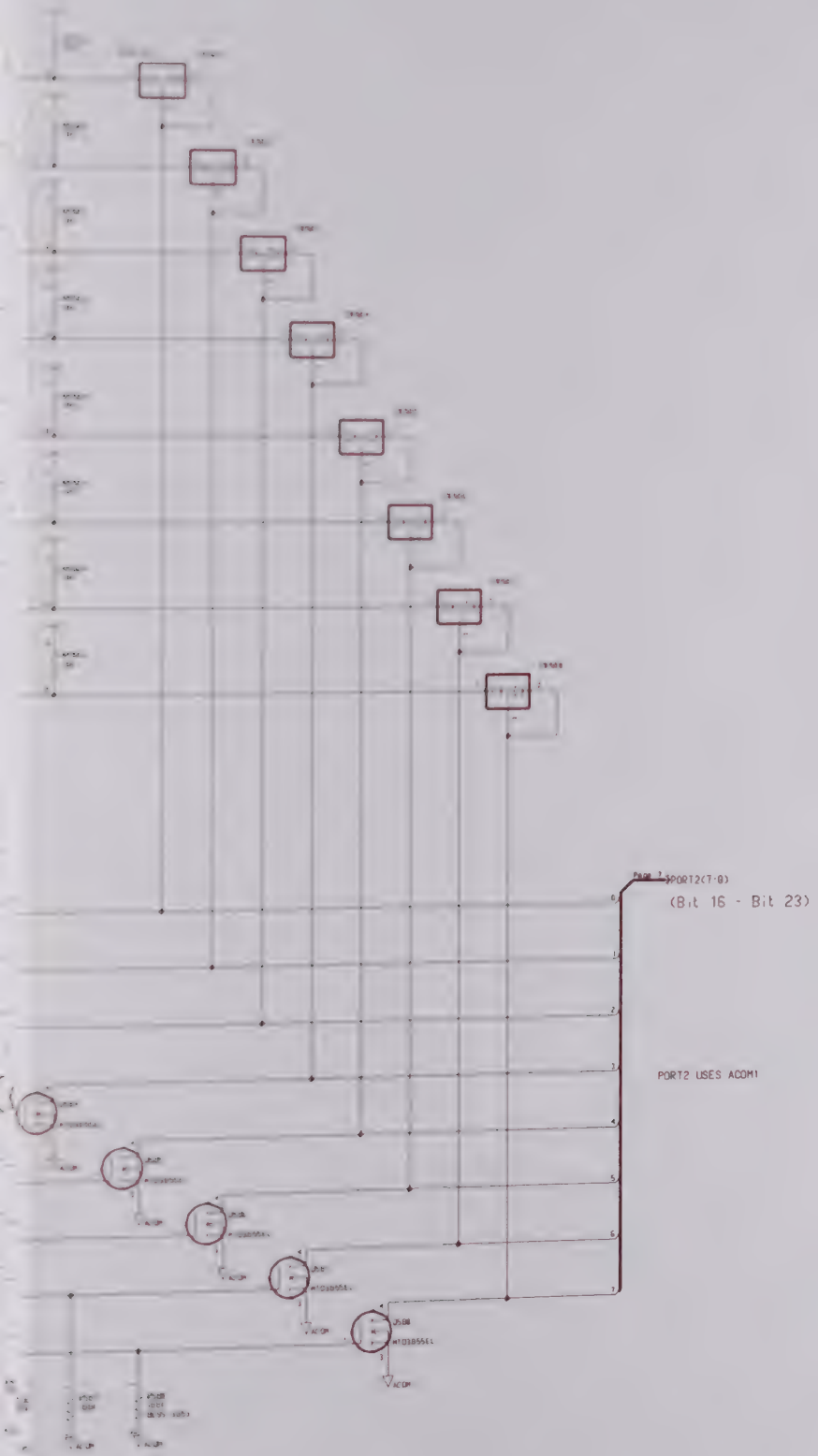
Agilent N2263A 32-Bit Digital I/O Module
Schematics -- Sheet 3 of 7


TTL_REF
Page 3, 5, 6
VCC=VCC GND=DCOM
U401
1826-1225
LP339M
RP401
3.3K
TTL_REF
U402
RP402
VCC
RP407
10K
1870-1580
RP408
10K
PORT1_IN(7:0)
Page 1
PORT1_OUT(7:0)
Page 2
PORT1_DR(7:0)
Page 2
Q401
1855-0888
WTD3055EL
Q402
Q403
ACOM
R401
10K
R402
10K
R403
10K
R404
10K
R405
10K
Bypass capacitors for some U IC
C401
0.1u
C402
0.1u
8168-7798
DCOM

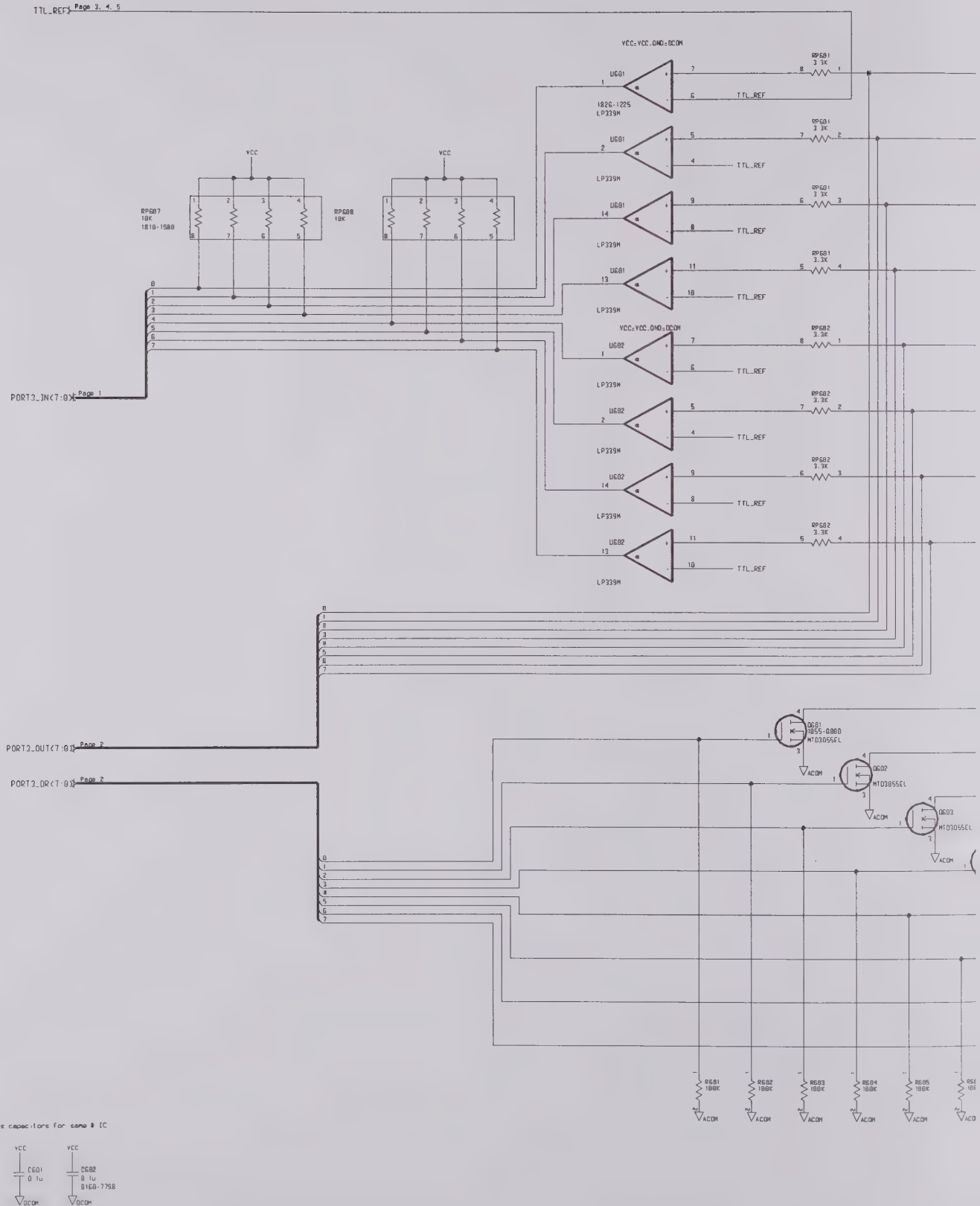


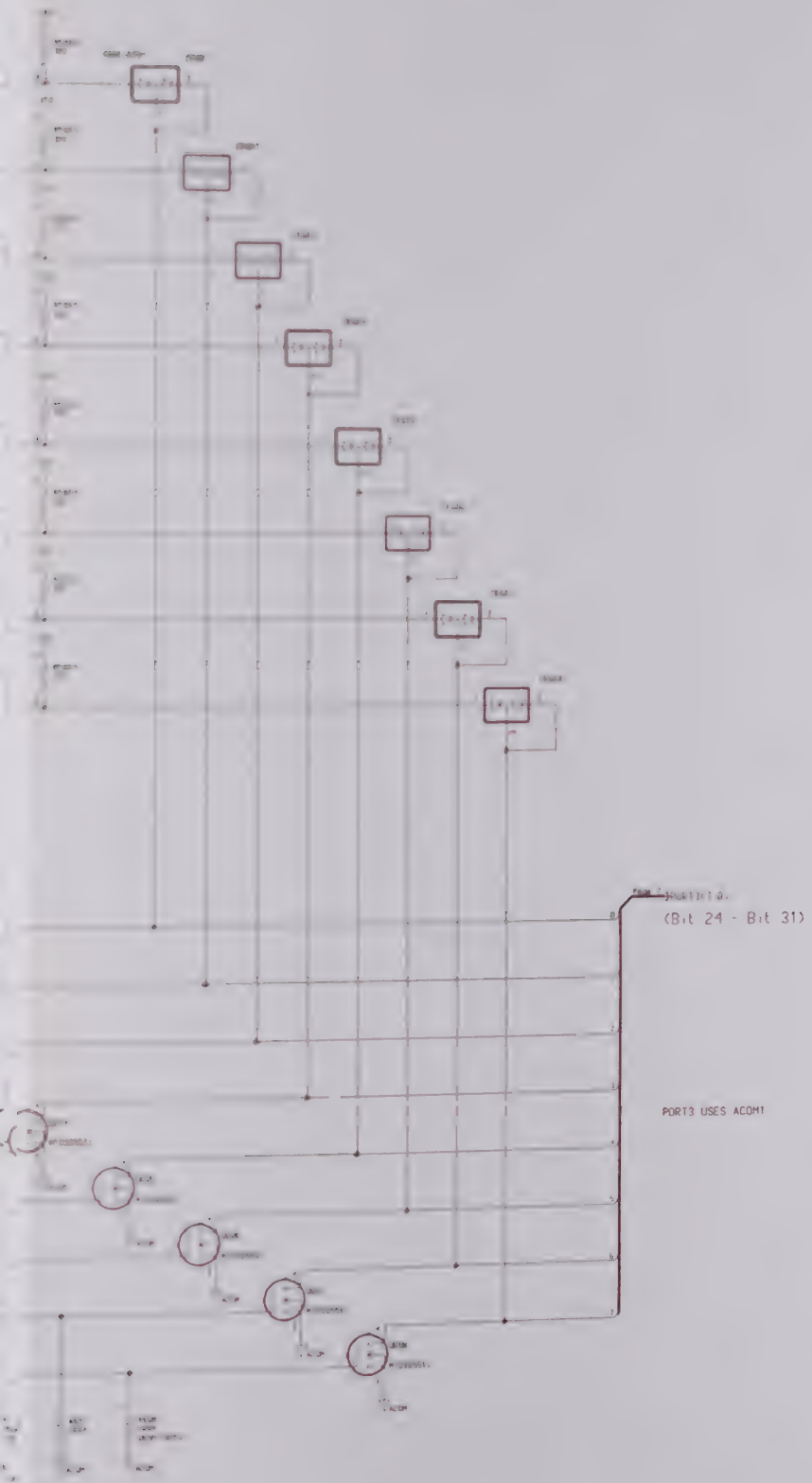
Agilent N2263A 32-Bit Digital I/O Module
Schematics -- Sheet 4 of 7


TTL_REF
Page 3, 4, 6
VCC=VCC,GND=DCOM
U501
1826-1225
LP339M
RP501
3.3K
TTL_REF
VCC
RP507
10K
1810-1588
RP508
10K
U502
RP502
PORT2_IN(7:0)
Page 1
PORT2_OUT(7:0)
Page 2
PORT2_DR(7:0)
Page 2
Q501
1855-0808
MTD3055EL
Q502
ACOM
R501
R502
R503
R504
R505
100K
Bypass capacitors for same 8 IC
C501
C502
8 1u
8168-7798
DCOM



Agilent N2263A 32-Bit Digital I/O Module
Schematics -- Sheet 5 of 7

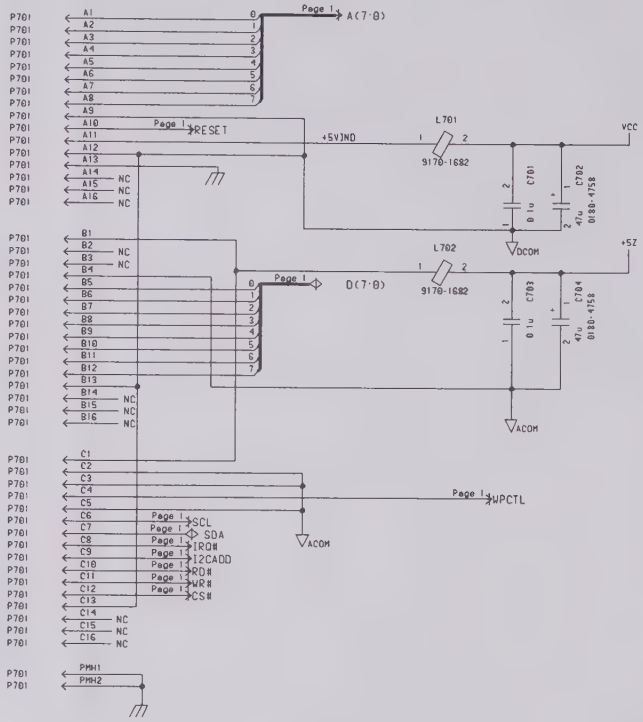

TTL_REF
Page 3, 4, 5
VCC=VCC,GND=DCOM
U601
1826-1225
LP339M
RP601
3.3K
TTL_REF
VCC
RP687
10K
1810-1588
RP688
10K
PORT3_IN<7:0>
Page 1
U602
RP682
PORT3_OUT<7:0>
Page 2
PORT3_DR<7:0>
Page 2
DG01
1855-0800
MTD3055EL
DG02
DG03
ACOM
RG01
RG02
RG03
RG04
RG05
100K
Bypass capacitors for some 8 IC
VCC
DCOM
CG01
0.1u
CG02
0.1u
0160-7758



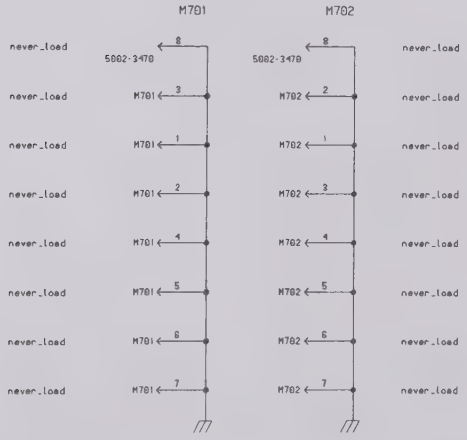
Agilent N2263A 32-Bit Digital I/O Module
Schematics -- Sheet 6 of 7

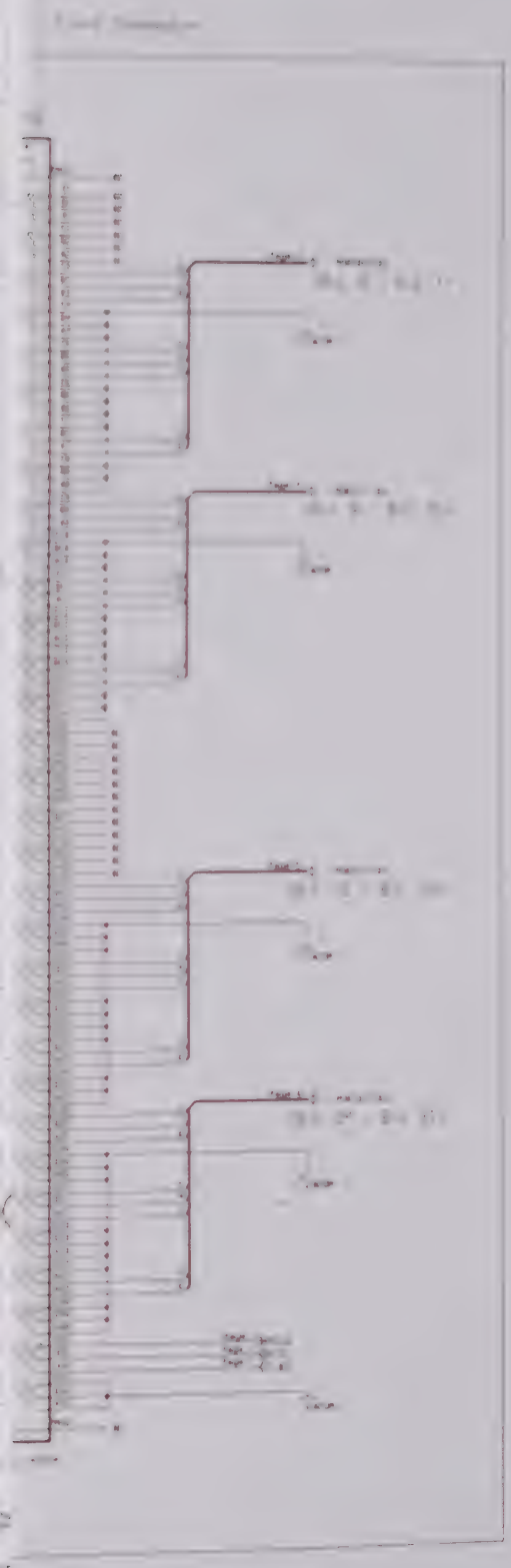
Backplane Connector

5184-0582

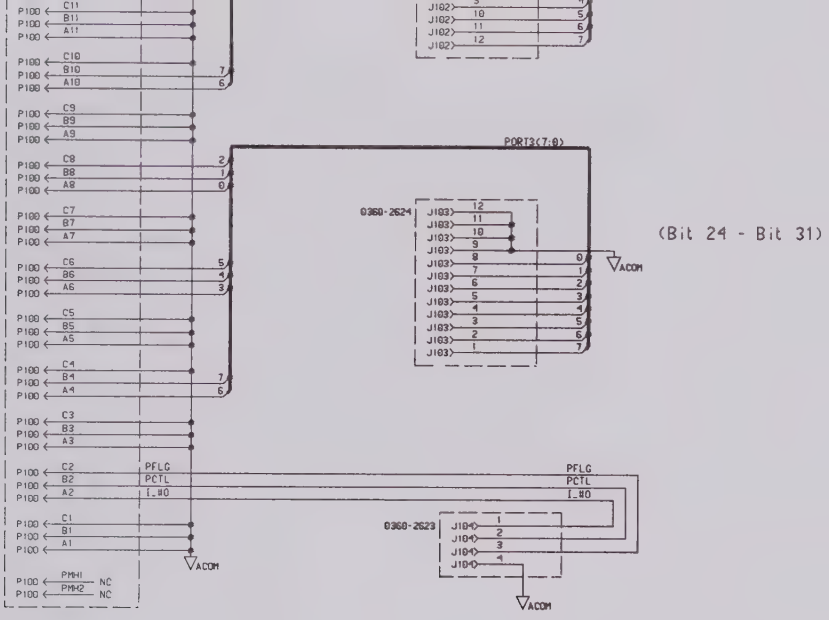


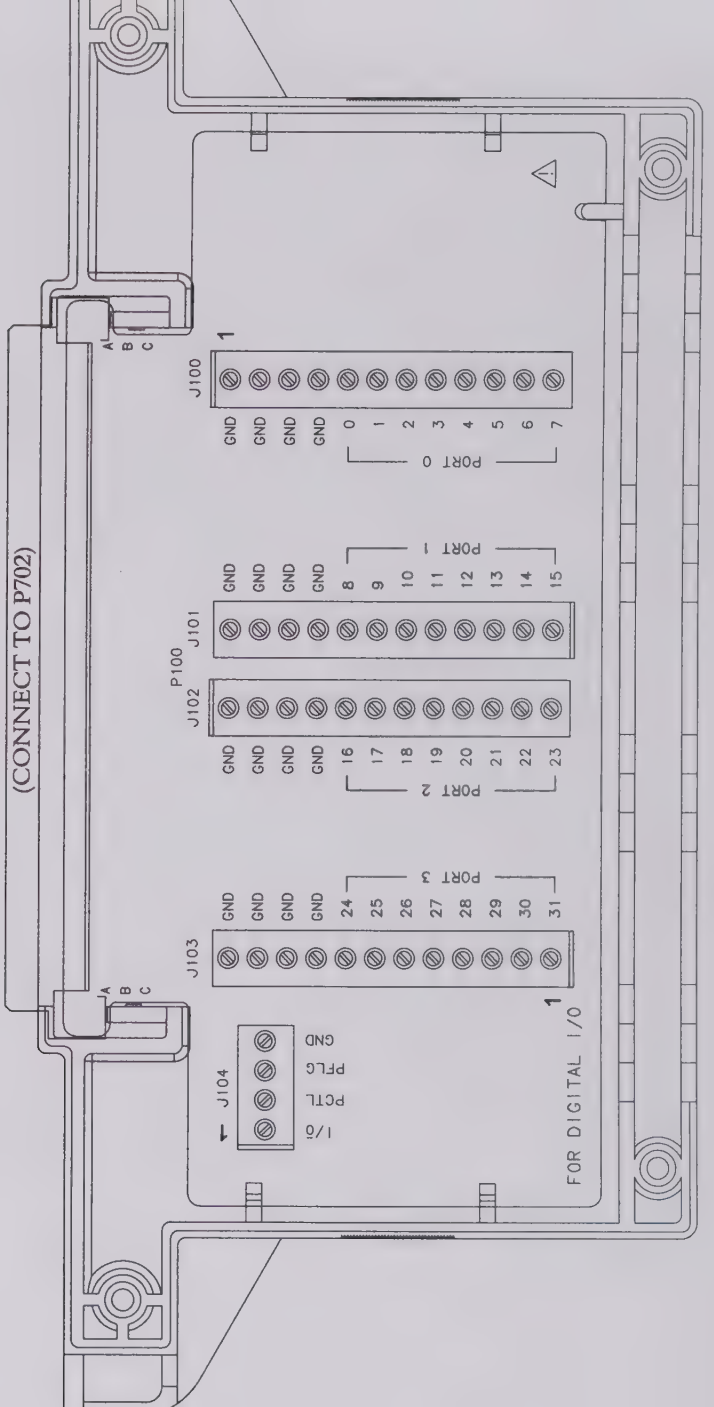
Two Mounting Holes with Soldermask

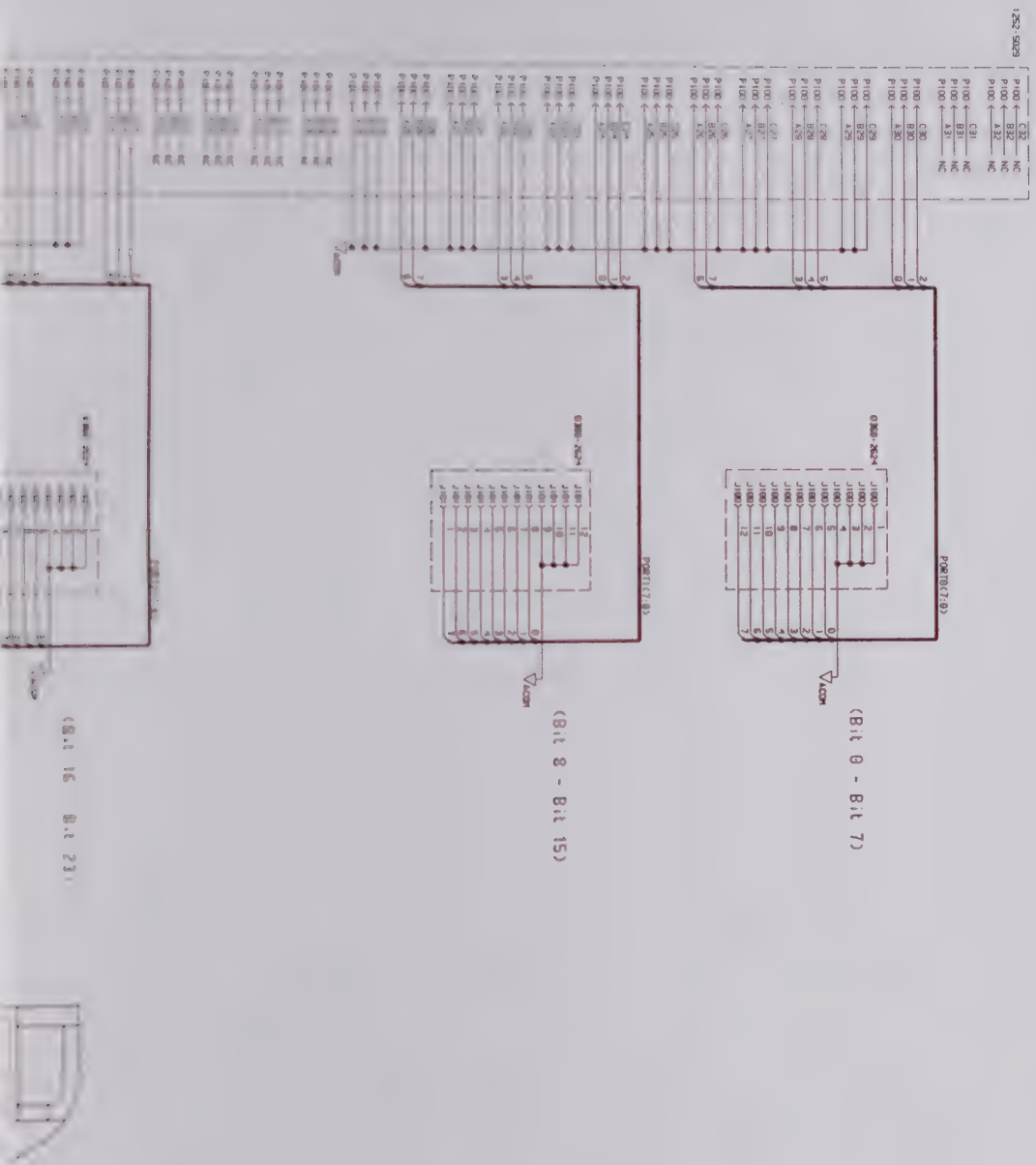




Agilent N2263A 32-Bit Digital I/O Module
Schematics -- Sheet 7 of 7

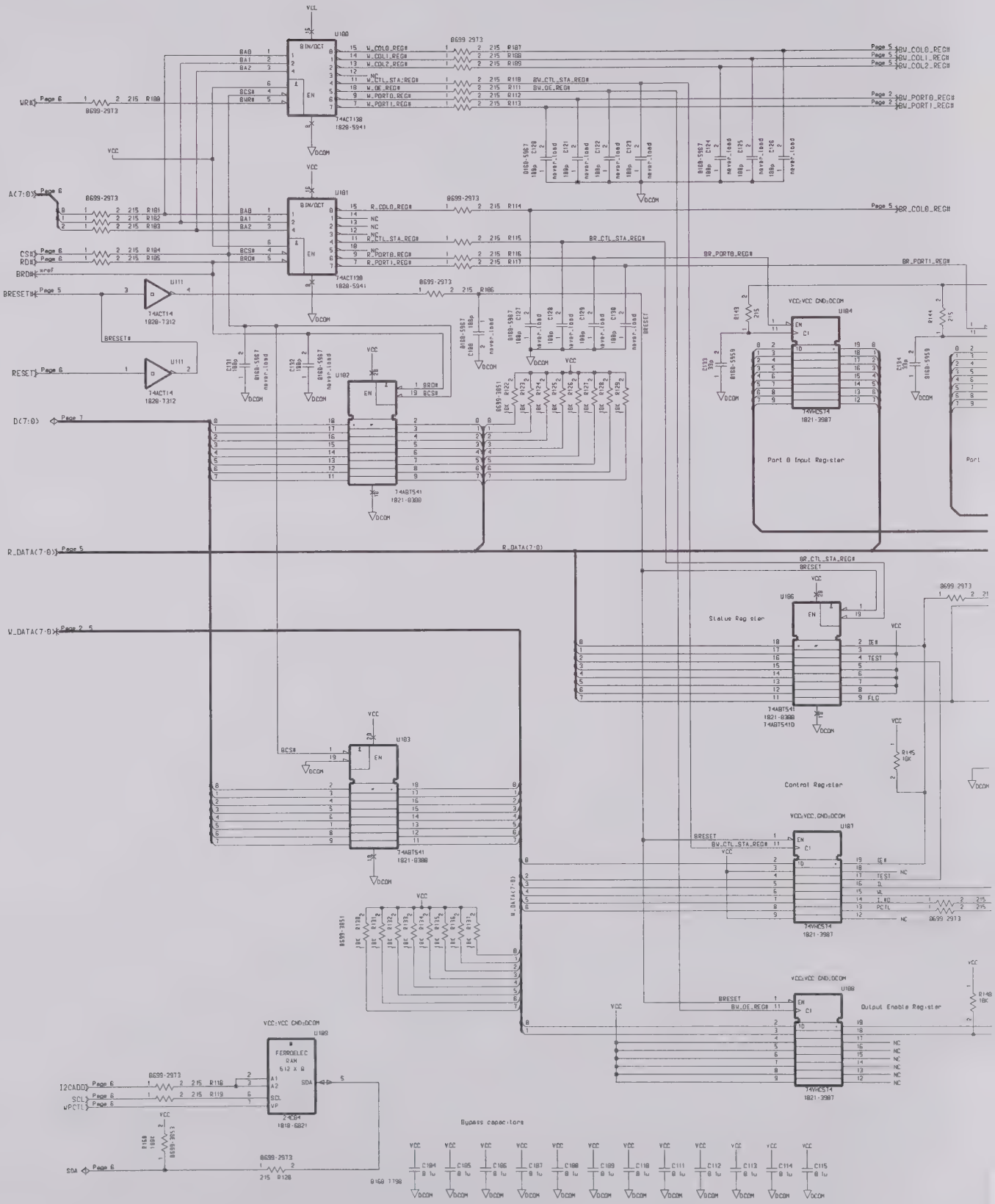

PORT3(7:0)
(Bit 24 - Bit 31)
0360-2624
0360-2623
PFLG
PCTL
I_#0
ACOM
PMH1
PMH2
NC

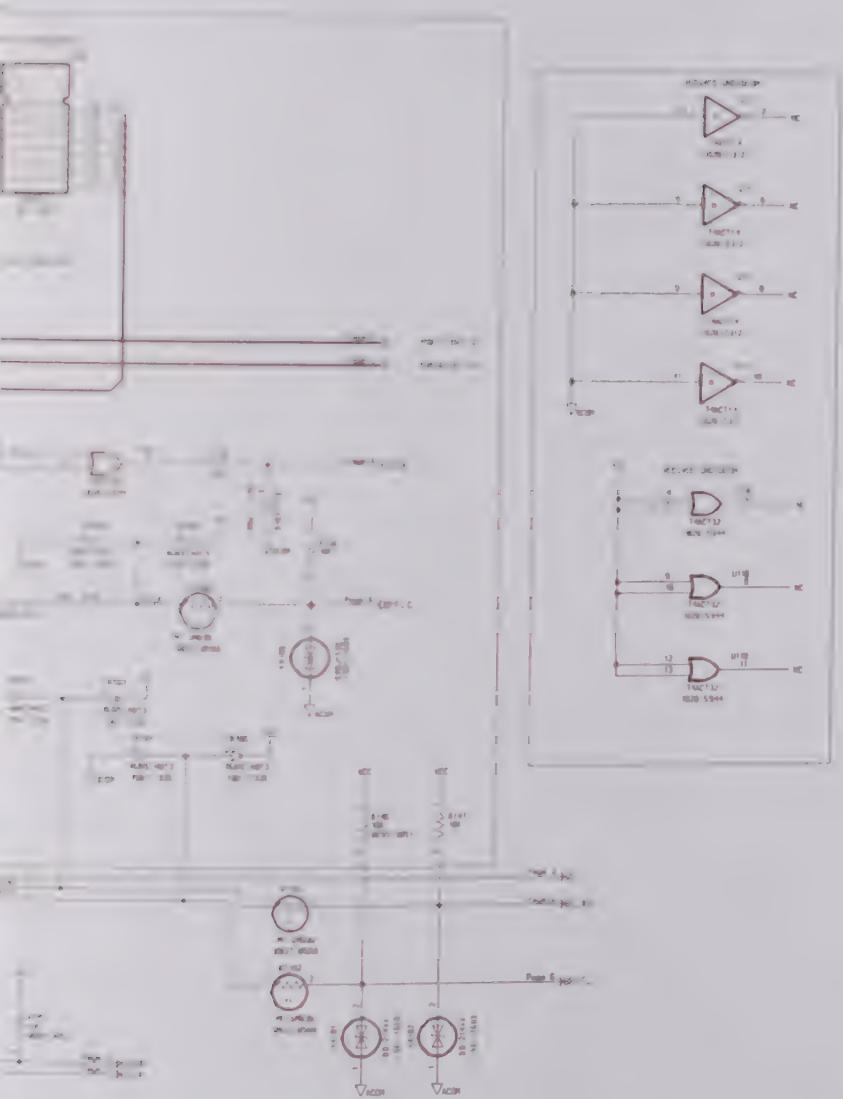

(CONNECT TO P702)
P100
J100
J101
J102
J103
J104
PORT 0
PORT 1
PORT 2
PORT 3
GND
PFLG
PCTL
I/O
FOR DIGITAL I/O


(Bit 8 - Bit 15)
(Bit 0 - Bit 7)

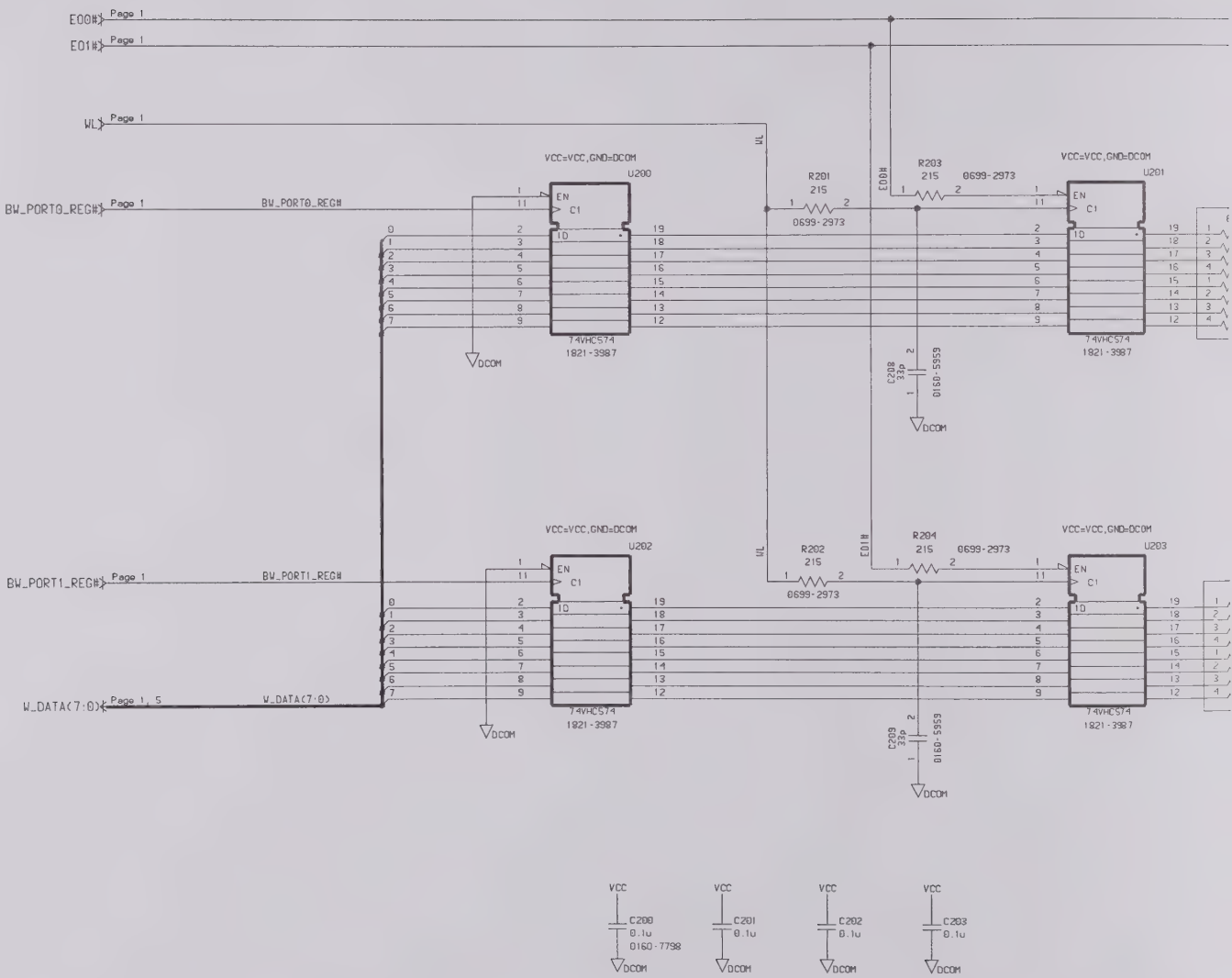
P600
MH601
MH600
U204
U205
U201
U200
U108
U203
U202
U103
U104
U105
U102
U106
U107
U501
U502
U503
U500
U401
U402
U301
U302
K500
K501
K502
K503
K504
K505
K506
K507
K508
K509
K510
K511
K512
K513
K514
Q301
Q302
Q303
Q304
Q305
Q306
Q307
Q308
Q401
Q402
Q403
Q404
Q405
Q406
Q407
Q408
Q500
Q501
Q502
Q503
Q504
Q505
Q506
Q507
Q508
Q509
Q510
Q511
Q512
Q513
Q514
CR300
CR301
CR302
CR303
CR304
CR305
CR306
CR307
CR400
CR401
CR402
CR403
CR404
CR405
CR406
CR407
CR100
CR101
CR102
CR103
CR104
CR105
CR500
CR501
CR502
CR503
CR504
CR505
CR506
CR507
CR508
CR509
CR510
CR511
CR512
CR513
CR514
RP201
RP202
RP203
RP204
RP301
RP302
RP303
RP304
RP307
RP308
RP401
RP402
RP403
RP404
RP407
RP408
VR100
VR101
VR102
RT100
RT101
RT102
RT10
L601
L602
L603
C605
C606
C518
C519
C520
C521
C522
C515
C516
C517
C510
C511
C512
C513
C514
C509
R540
R531
R532
R533
R534
R512
R513
R514
R508
R509
R510
R511
R108
R109
C125
C124

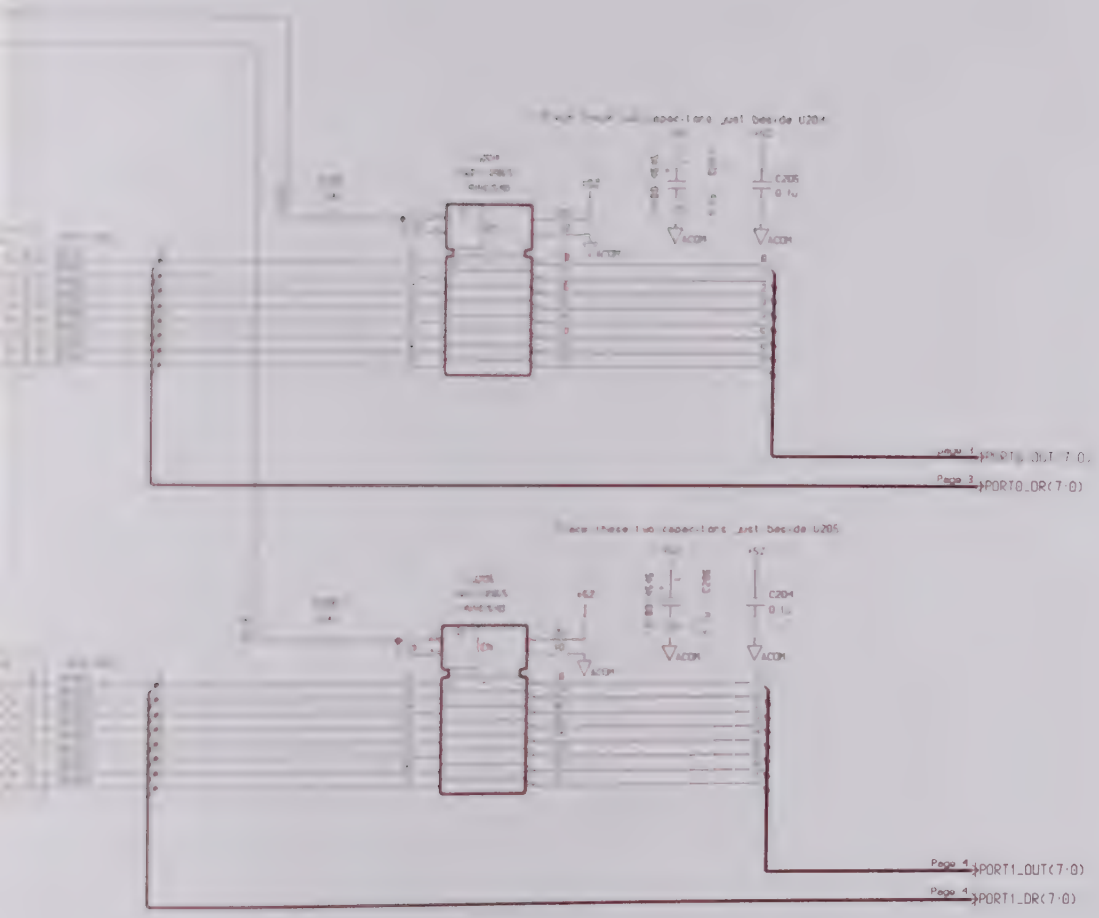
Agilent N2264A Multifunction Module
Components Locator


VCC
U100
BIN/OCT
74ACT138
1828-5941
8699-2973
W_COL0_REG#
W_COL1_REG#
W_COL2_REG#
W_CTL_STA_REG#
W_OE_REG#
W_PORT0_REG#
W_PORT1_REG#
BW_CTL_STA_REG#
BW_OE_REG#
WR#
A(7:0)
U101
R_COL0_REG#
R_CTL_STA_REG#
R_PORT0_REG#
R_PORT1_REG#
BR_CTL_STA_REG#
BR_PORT0_REG#
BR_PORT1_REG#
CS#
RD#
BRD#
BRESET#
U111
74ACT14
1828-7312
RESET#
U102
74ABT541
1821-8388
D(7:0)
R_DATA(7:0)
W_DATA(7:0)
U104
74VHC574
1821-3587
Part B Input Register
Part
Status Register
U106
Control Register
U107
U108
Output Enable Register
U103
U109
FERROELEC
RAM
512 x 8
2-WIRE
1818-6821
I2CADD
SCL
SDA
WPCTL
Bypass capacitors
never_load

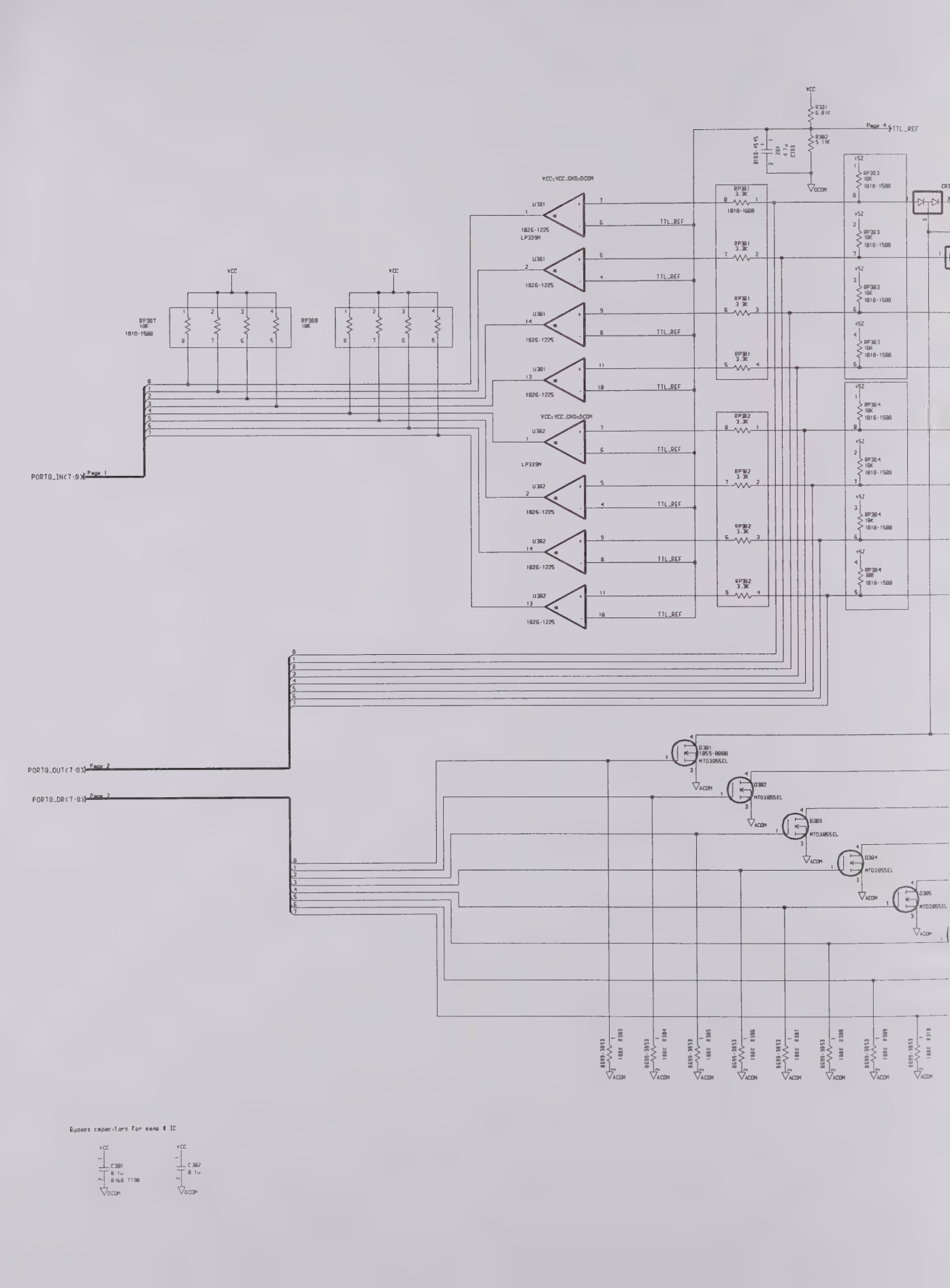


Agilent N2264A Multifunction Module
Schematics -- Sheet 1 of 6

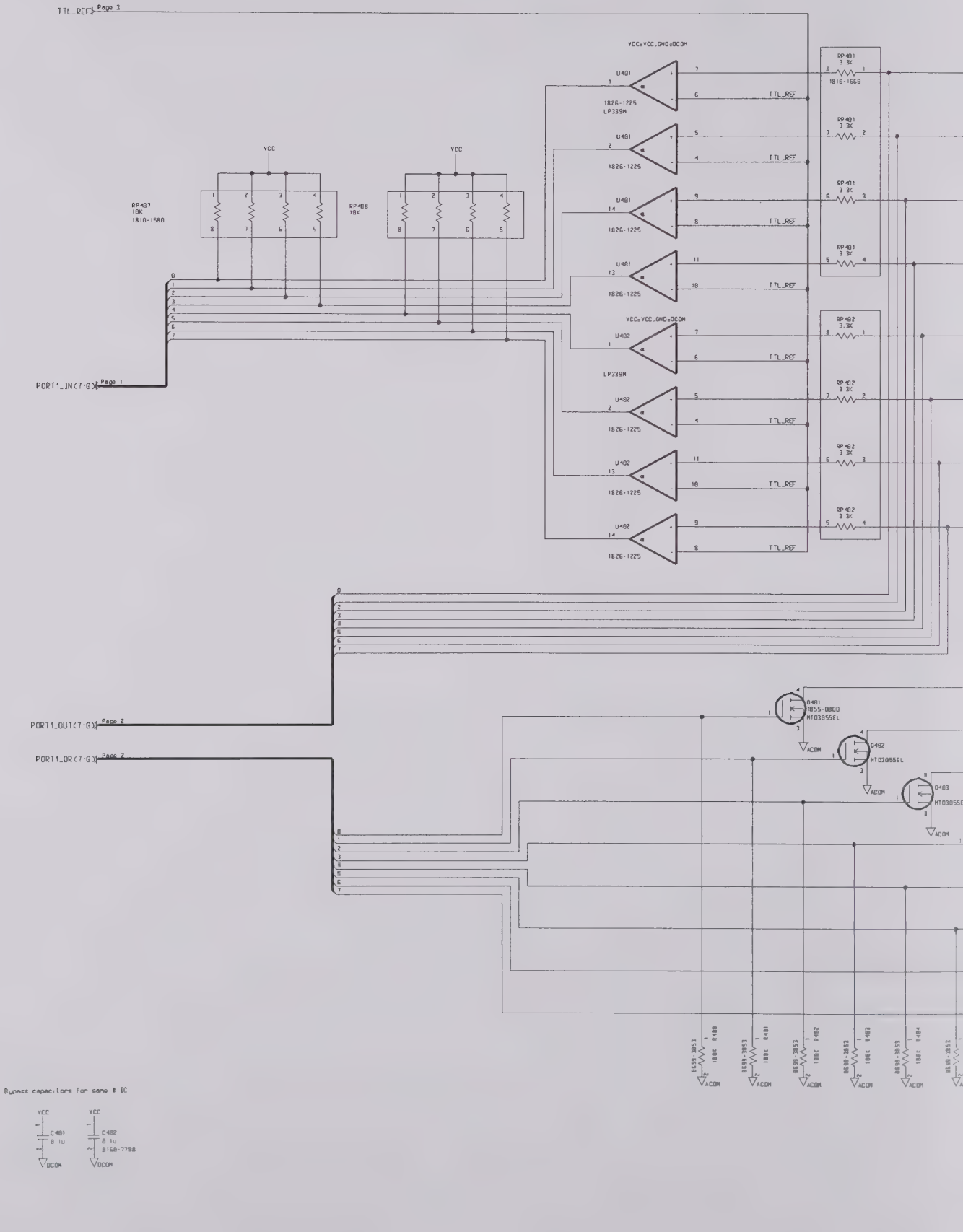

E00#
Page 1
E01#
Page 1
WL
Page 1
BW_PORT0_REG#
Page 1
BW_PORT0_REG#
BW_PORT1_REG#
Page 1
BW_PORT1_REG#
W_DATA(7:0)
Page 1, 5
W_DATA(7:0)
VCC=VCC,GND=DCOM
U200
U201
U202
U203
74VHC574
1821-3987
R201
215
0699-2973
R202
215
0699-2973
R203
215
0699-2973
R204
215
0699-2973
E00#
E01#
WL
C208
33p
0160-5959
C209
33p
0160-5959
DCOM
VCC
C200
0.1u
0160-7798
C201
0.1u
C202
0.1u
C203
0.1u

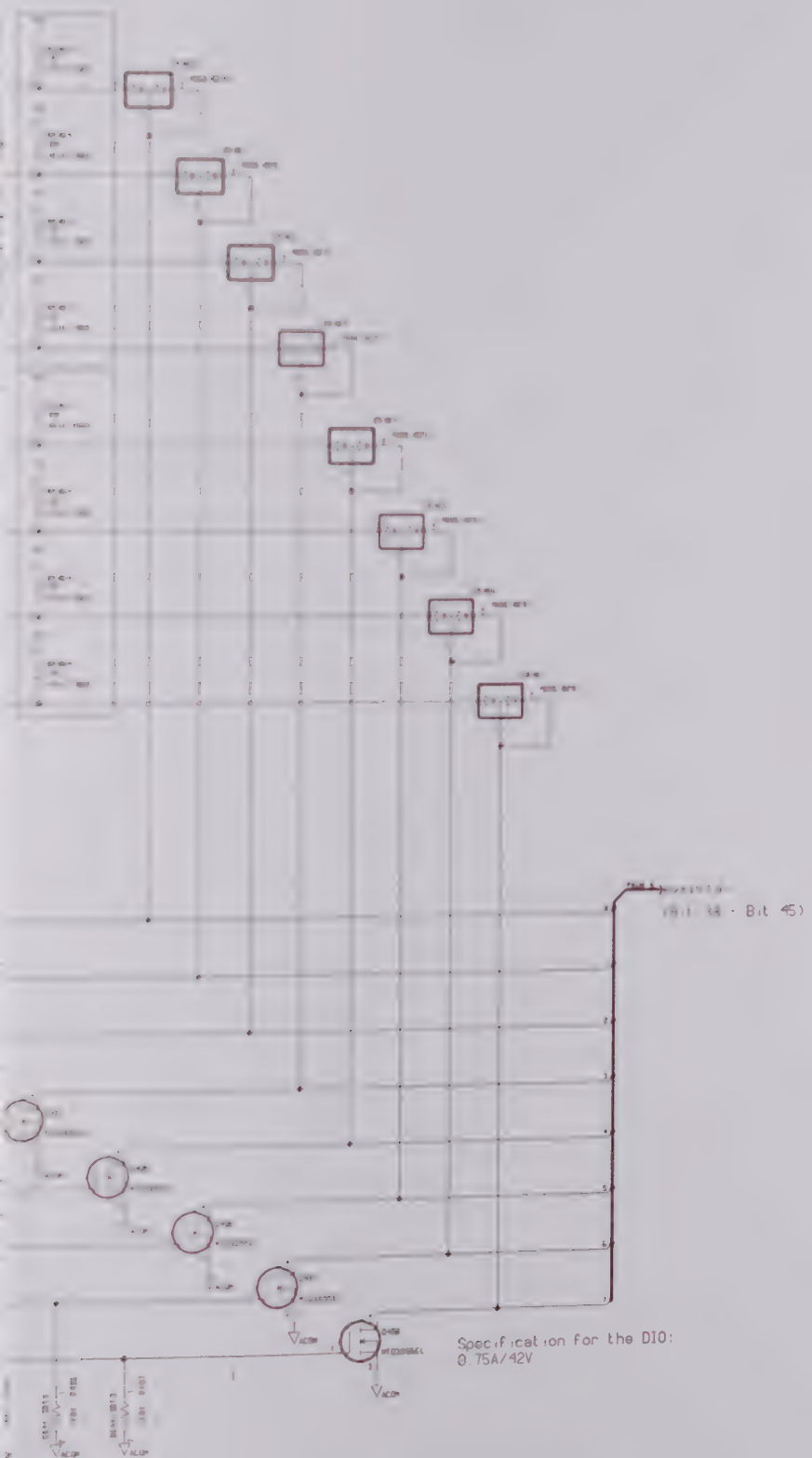


Agilent N2264A Multifunction Module
Schematics -- Sheet 2 of 6

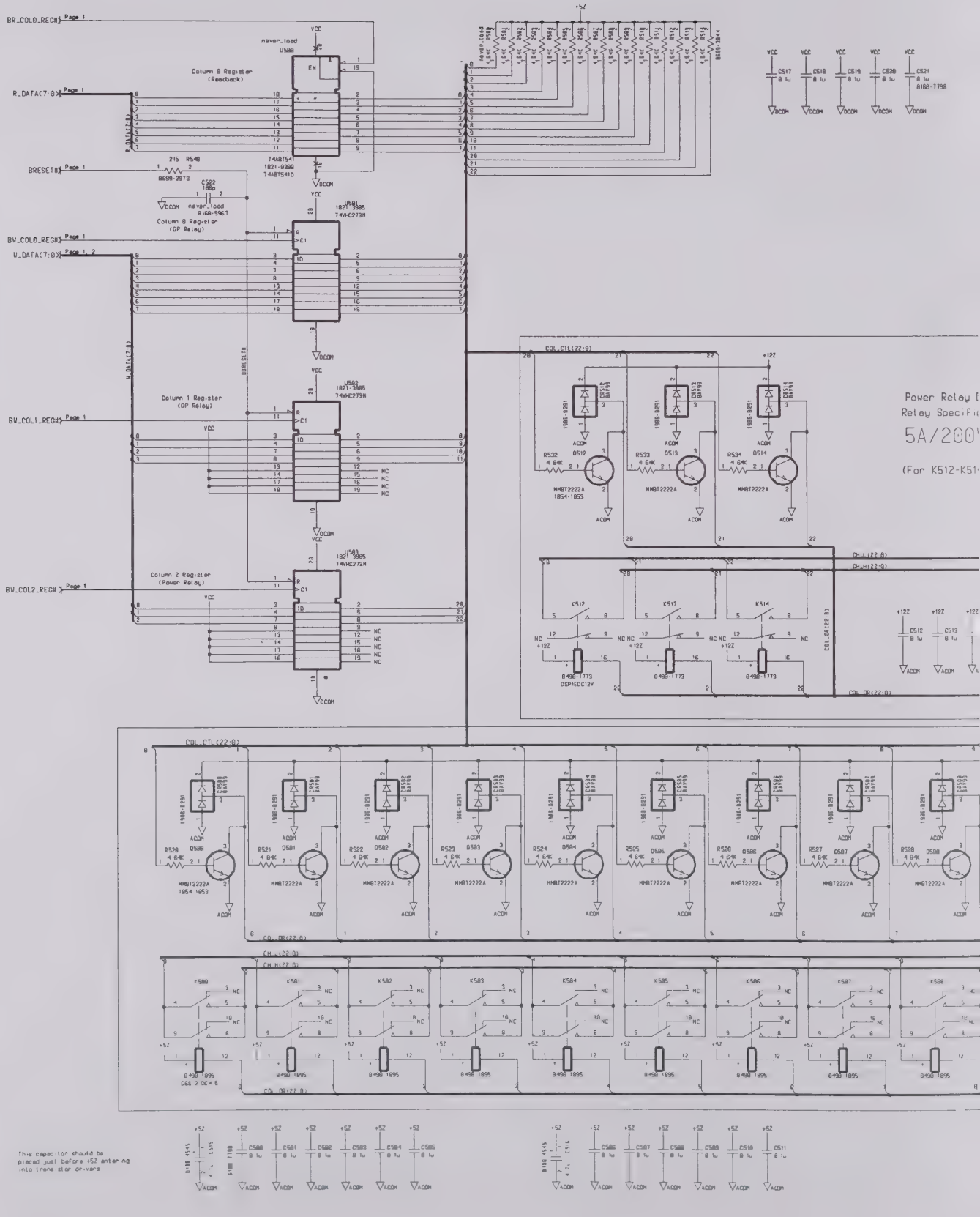

VCC
R381
6.81K
R382
5.11K
Page 4
TTL_REF
VCC=VCC,GND=DCOM
U381
1826-1225
LP339M
RP381
3.3K
1818-1600
RP383
10K
1818-1500
PORTB_IN<7:0>
Page 1
RP387
10K
1818-1500
RP388
10K
U382
PORTB_OUT<7:0>
Page 2
PORTB_DR<7:0>
Page 2
Q381
1855-0888
MTD3055EL
Q382
Q384
Q385
ACOM
DCOM
Bypass capacitors for same 8 IC
C381
0.1u
0160-1798
C382
0.1u

Agilent N2264A Multifunction Module
Schematics -- Sheet 3 of 6

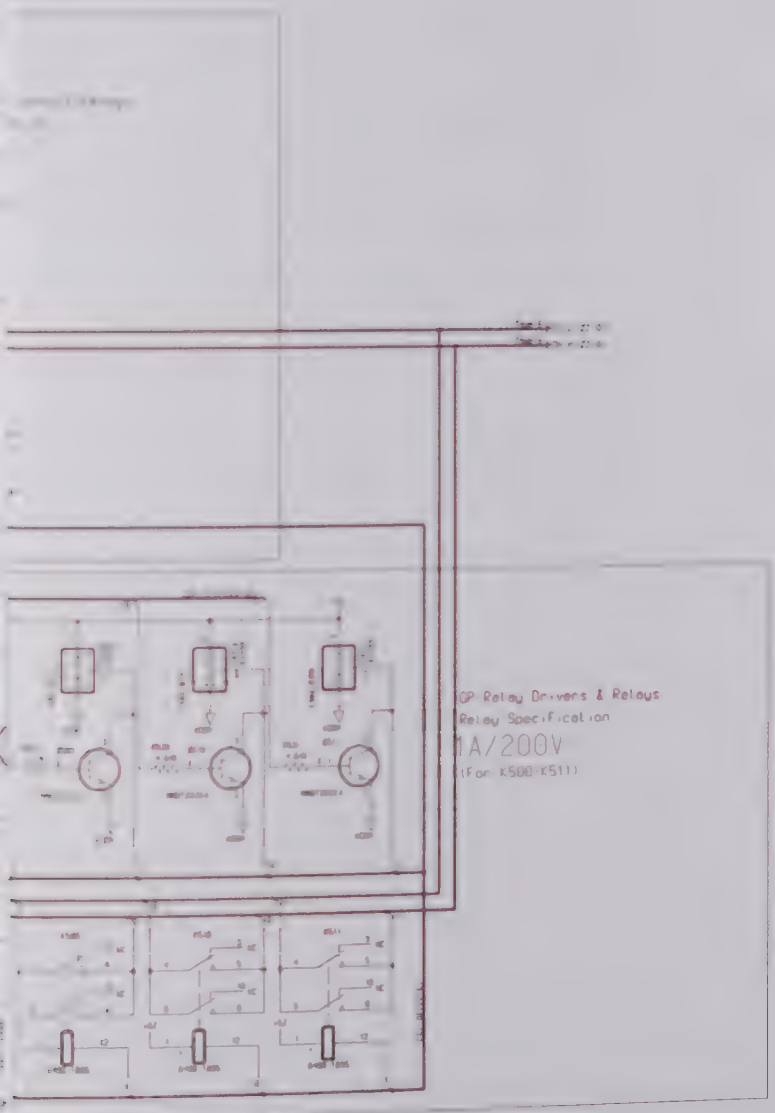

TTL_REF
Page 3
VCC=VCC,GND=DCOM
U401
1826-1225
LP339M
RP401
3.3K
1810-1660
RP407
10K
1810-1580
RP408
10K
VCC
TTL_REF
U402
PORT1_IN(7:0)
Page 1
PORT1_OUT(7:0)
Page 2
PORT1_DR(7:0)
Page 2
Q401
1855-8888
MTD3055EL
Q402
Q403
ACOM
Bypass capacitors for some A IC
C401
0.1u
8168-7798
C402
DCOM



Agilent N2264A Multifunction Module
Schematics -- Sheet 4 of 6

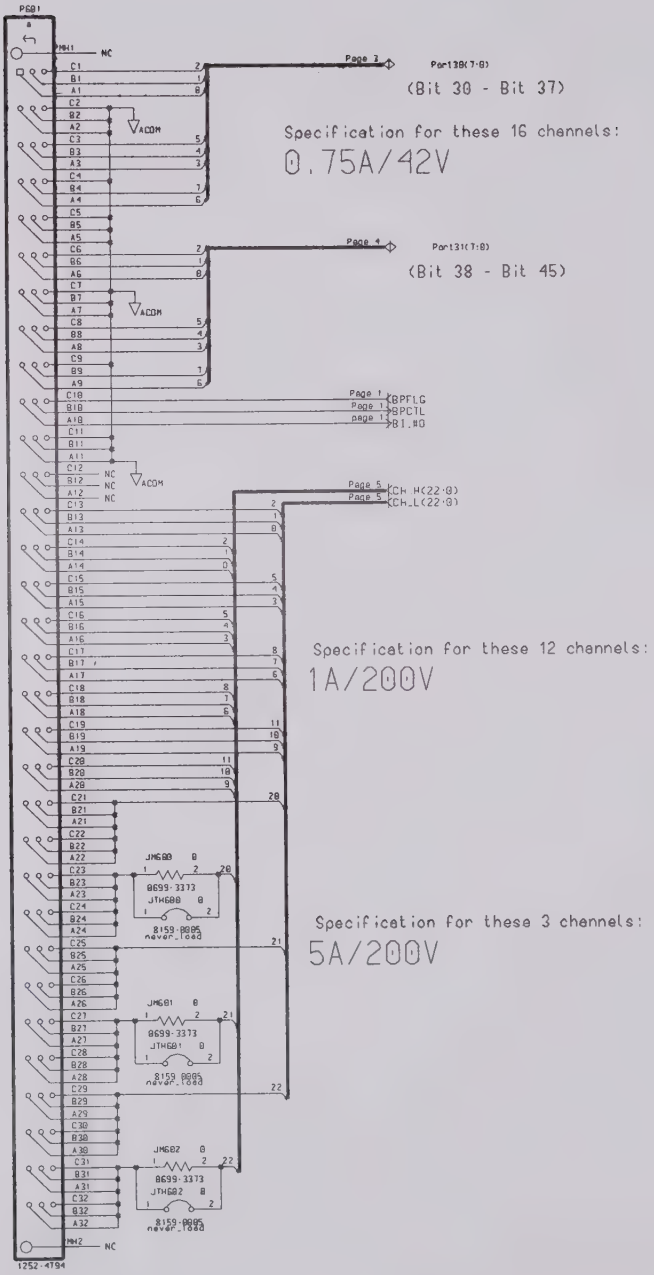


This capacitor should be placed just before +5Z entering into transistor drivers

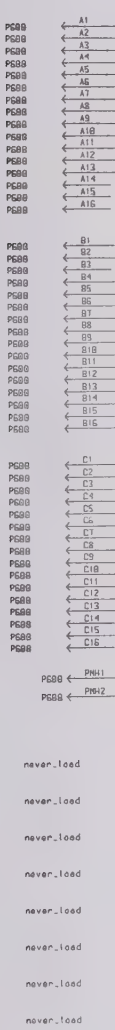


Agilent N2264A Multifunction Module
Schematics -- Sheet 5 of 6

Customer Connector



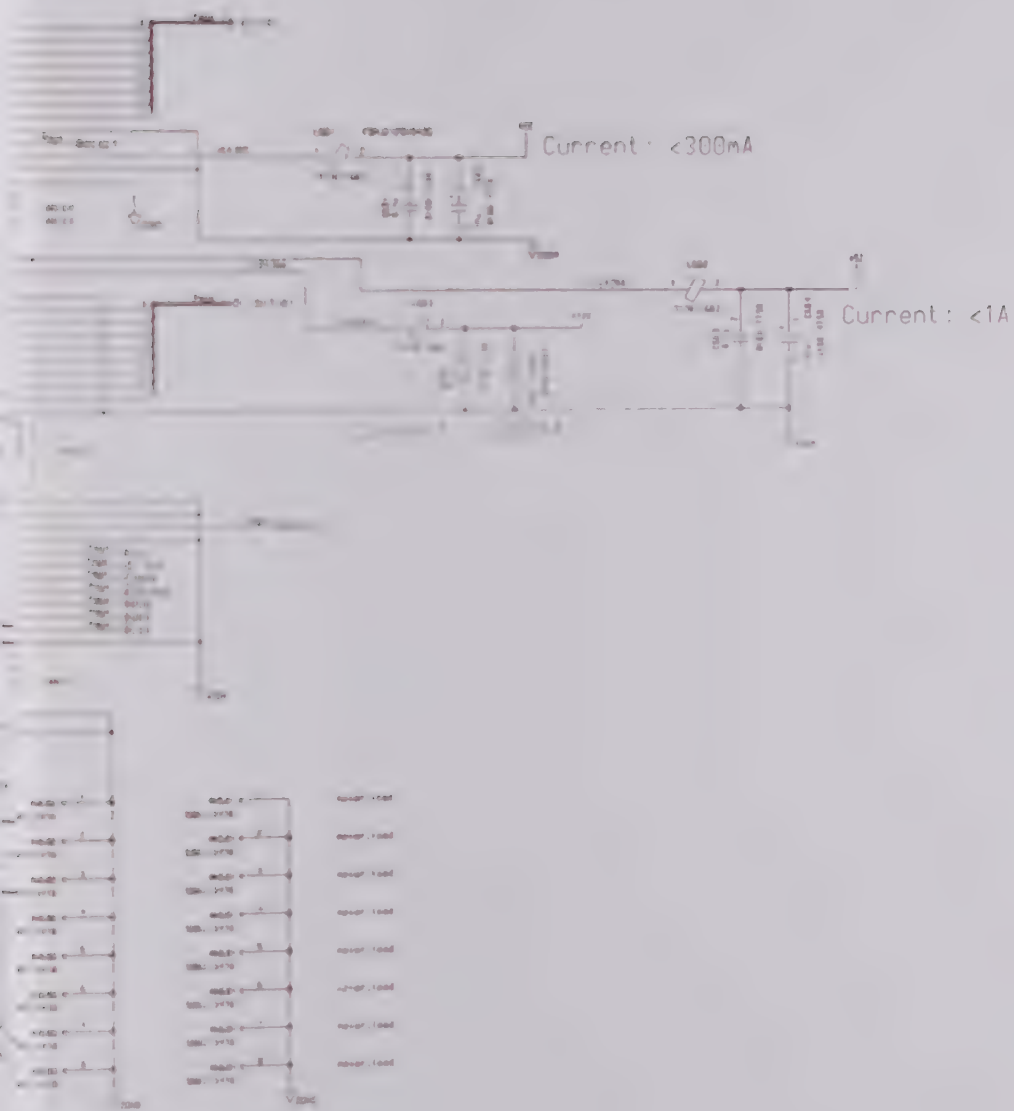
5184-0582



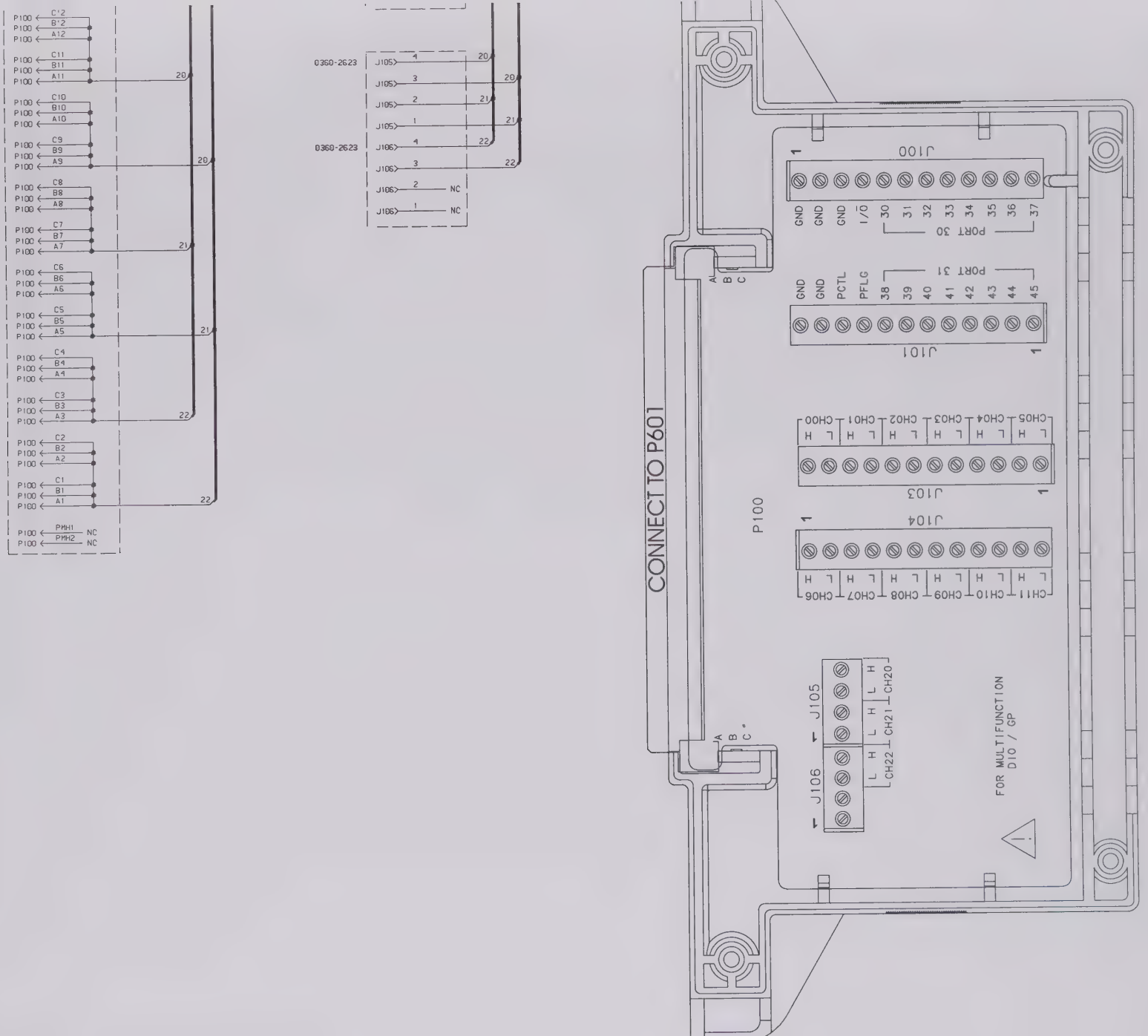
never_load
never_load
never_load
never_load
never_load
never_load
never_load
never_load

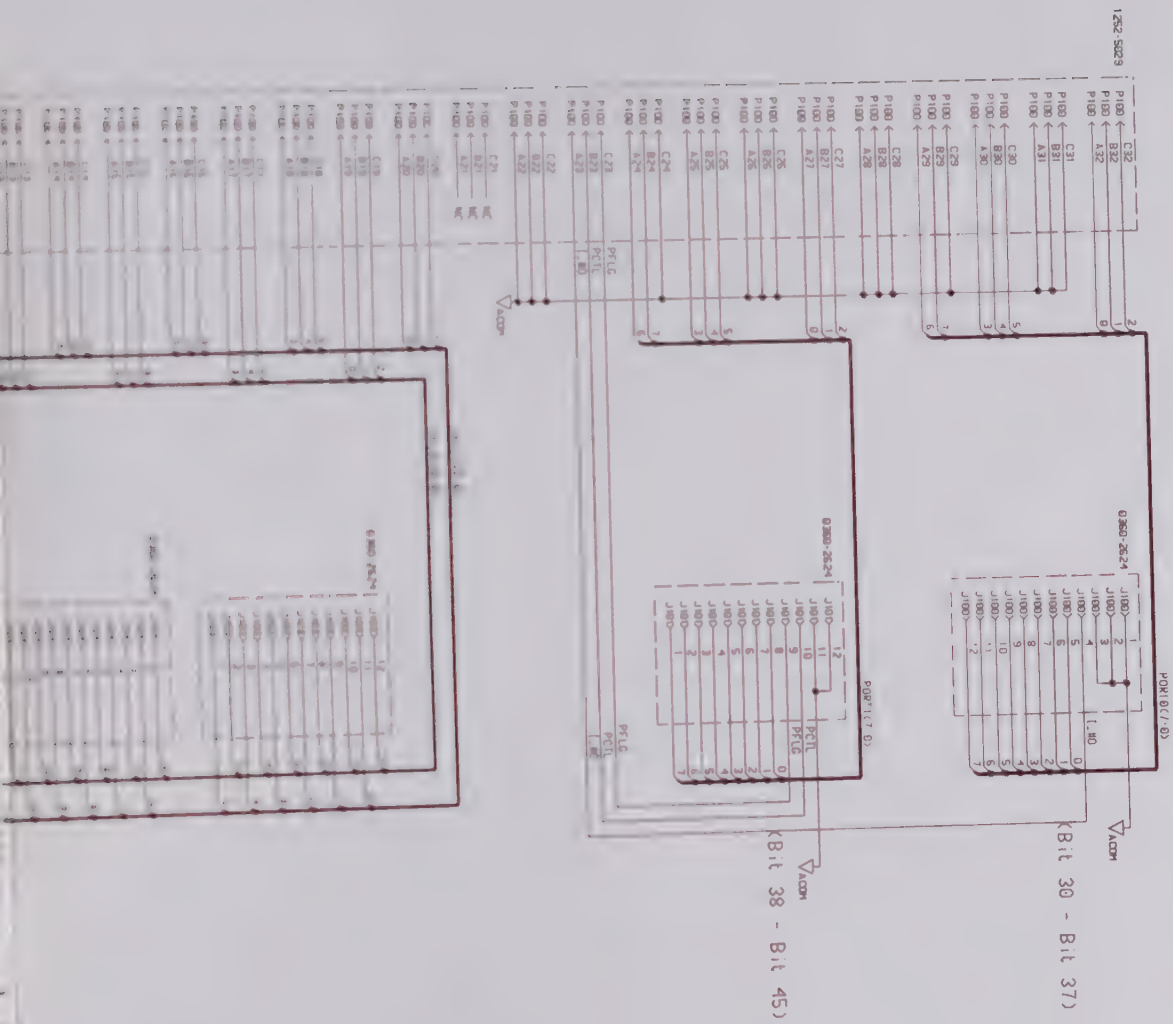
Note:

Please use 2 OZ copper on outerlayer!



Agilent N2264A Multifunction Module
Schematics -- Sheet 6 of 6

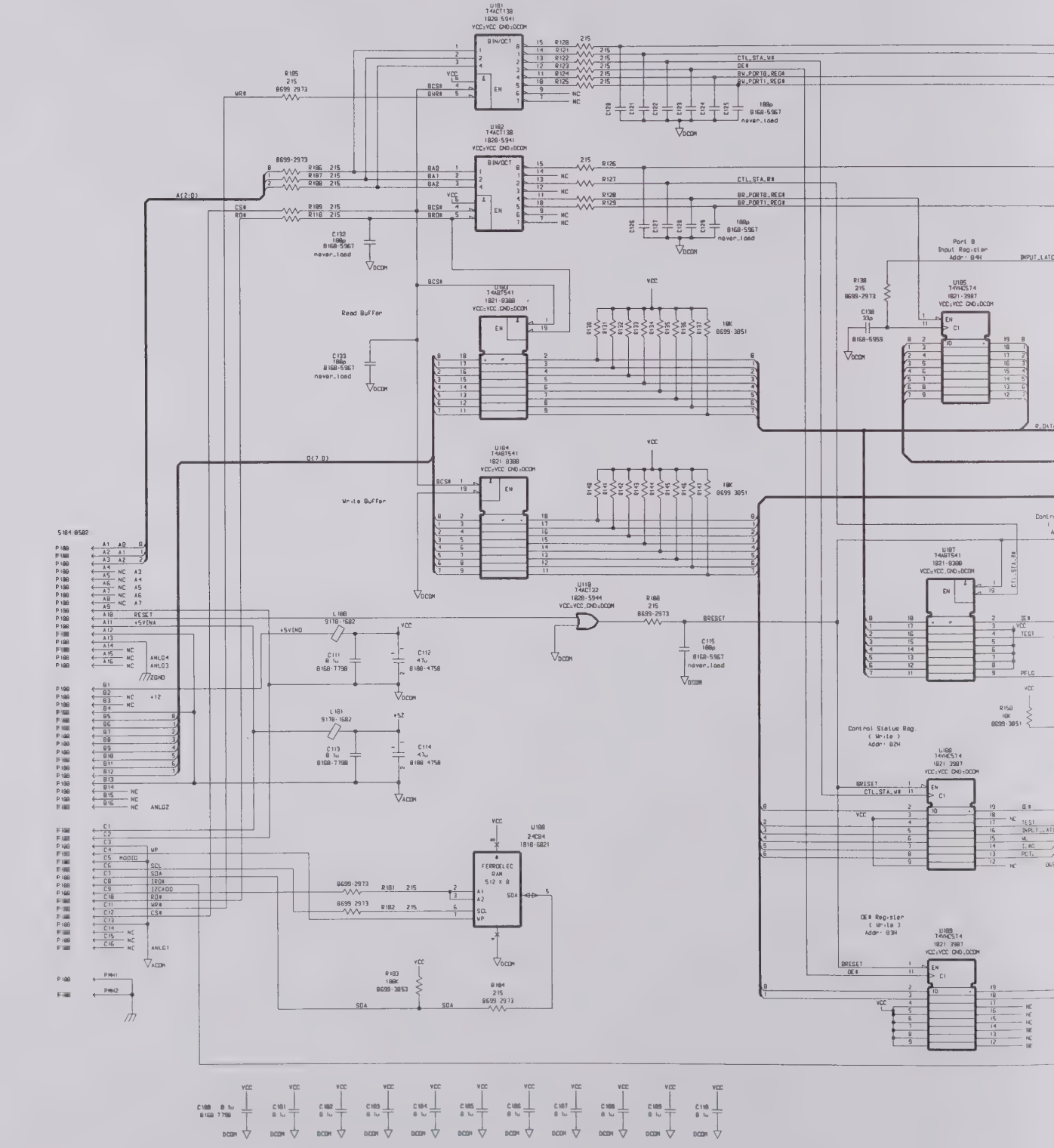

P100 C12 B12 A12
P100 C11 B11 A11
P100 C10 B10 A10
P100 C9 B9 A9
P100 C8 B8 A8
P100 C7 B7 A7
P100 C6 B6 A6
P100 C5 B5 A5
P100 C4 B4 A4
P100 C3 B3 A3
P100 C2 B2 A2
P100 C1 B1 A1
P100 PMH1 NC
P100 PMH2 NC
20
20
21
21
22
22
0360-2623
J105 4 20
J105 3 20
J105 2 21
J105 1 21
0360-2623
J106 4 22
J106 3 22
J106 2 NC
J106 1 NC
CONNECT TO P601
P100
A
B
C
J100
GND GND GND I/O 30 31 32 33 34 35 36 37
PORT 30
PORT 31
GND GND PCTL PFLG 38 39 40 41 42 43 44 45
J101
J103
CH05 CH04 CH03 CH02 CH01 CH00
J104
CH11 CH10 CH09 CH08 CH07 CH06
J105
J106
CH22 CH21 CH20
FOR MULTIFUNCTION DIO / GP

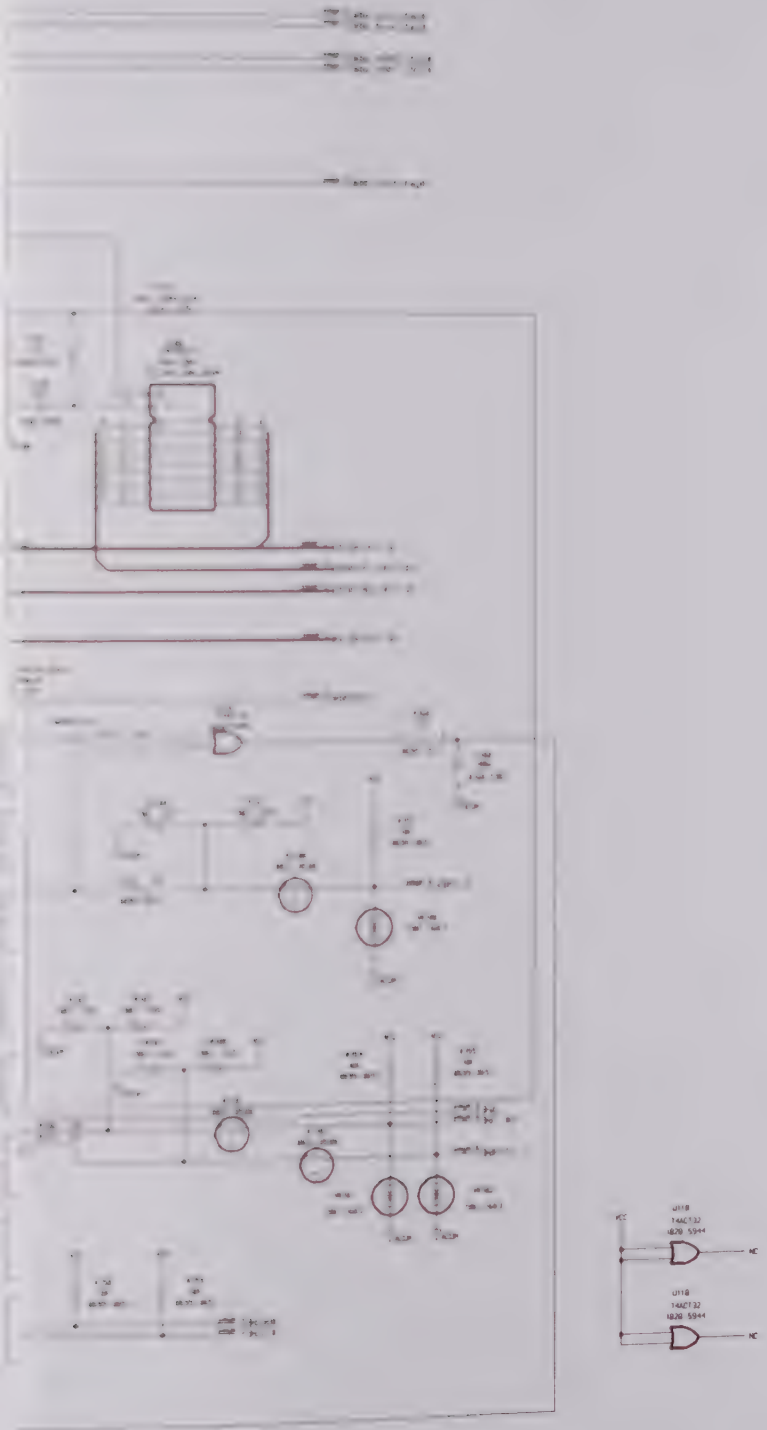

1252-5023
0360-2624
0360-2624
P100
J100
A_COM
PRTL
PRTG
KBit 38 - Bit 45)
KBit 30 - Bit 37)

P601
P100
C113
L101
C114
C503
Q503
Q540
Q541
Q542
Q543
C540
C542
Q550
Q551
Q552
Q553
CR540
CR541
CR542
CR543
CR531
CR530
CR532
CR533
CR520
CR521
CR522
CR523
CR510
CR511
CR512
CR513
CR500
CR501
CR502
CR503
CR534
CR506
CR524
CR514
CR505
CR504
K630
K620
K610
K631
K621
K611
K632
K622
K612
K633
K623
K613
U104
R146
R147
R144
R145
R142
R143
R140
R141
C104
C133
C510
C504
C511
C505
C512
C506
C513
R526
R527
R524
R525
R522
R523
R520
R521
U103
R136
R137
R134
R135
R132
R133
R130
R131
C103
C100
R103
C132
R101
U100
R102
R104
L100
C111
C112
R138
C138
U105
U500
U501
U502
C120
C121
R517
R516
R515
R514
R513
R512
R511
R510
C139
C500
C200
C501
R204
C502
C234
C204
R150
C110
C160
R151
C105
R139
C128
C126
R202
C202
U110
R160
R100
C115
R109
R108
R107
R110
R105
R106
C106
C129
C124
C201
R200
C210
C203
R205
C235
C205
U106
U200
U202
U204
RP200
RP201
RP300
C300
U300
R203
C101
U101
U107
U201
U203
U205
RP202
RP203
RP301
R120
R121
R122
R123
R124
C102
R125
C127
C107
R153
C108
C125
R201
C211
C109
C301
U301
U102
R126
R127
R128
R129
U108
U109
R158
R159
C122
R156
C123
R157
RP400
C400
U400
CR101
CR103
CR105
CR100
CR102
CR104
RP401
C401
U401
R310
Q302
R311
RT102
R155
VR102
P602
RP302
CR301
CR300
R301
Q301
R300
RP304
CR303
CR302
R303
Q303
R302
RP303
CR305
CR304
R305
Q305
R304
RP305
CR307
CR306
R307
Q307
R306
RP402
CR401
CR400
R401
Q401
R400
RP404
CR403
CR402
R403
Q403
R402
RP403
CR405
CR404
R405
Q405
R404
RP405
CR407
CR406
R407
Q407
R406
RT101
R154
VR101
RT100
R152

Agilent N2265A Multifunction Module
Components Locator

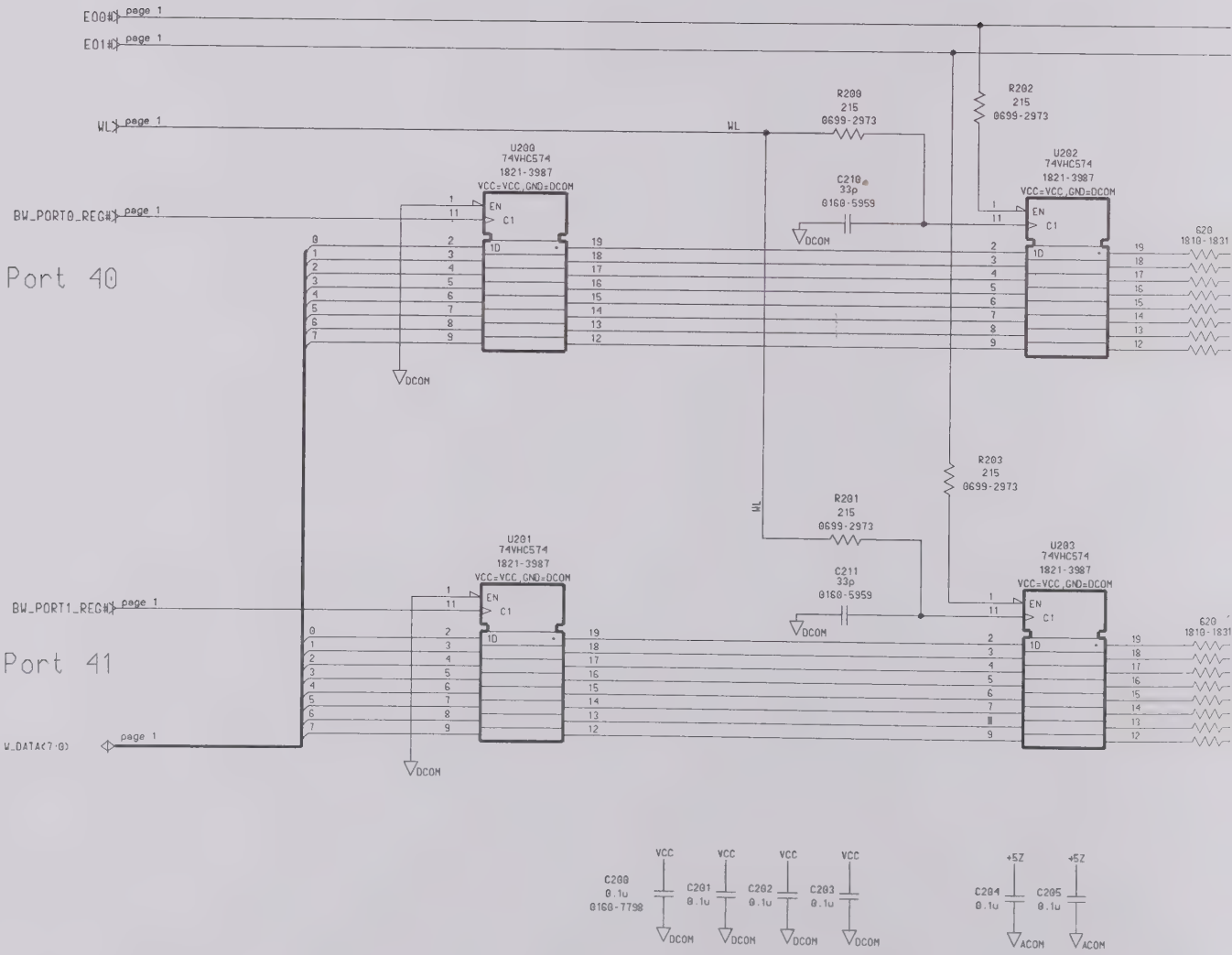
N2265A (Sheet 1) - Control Registers



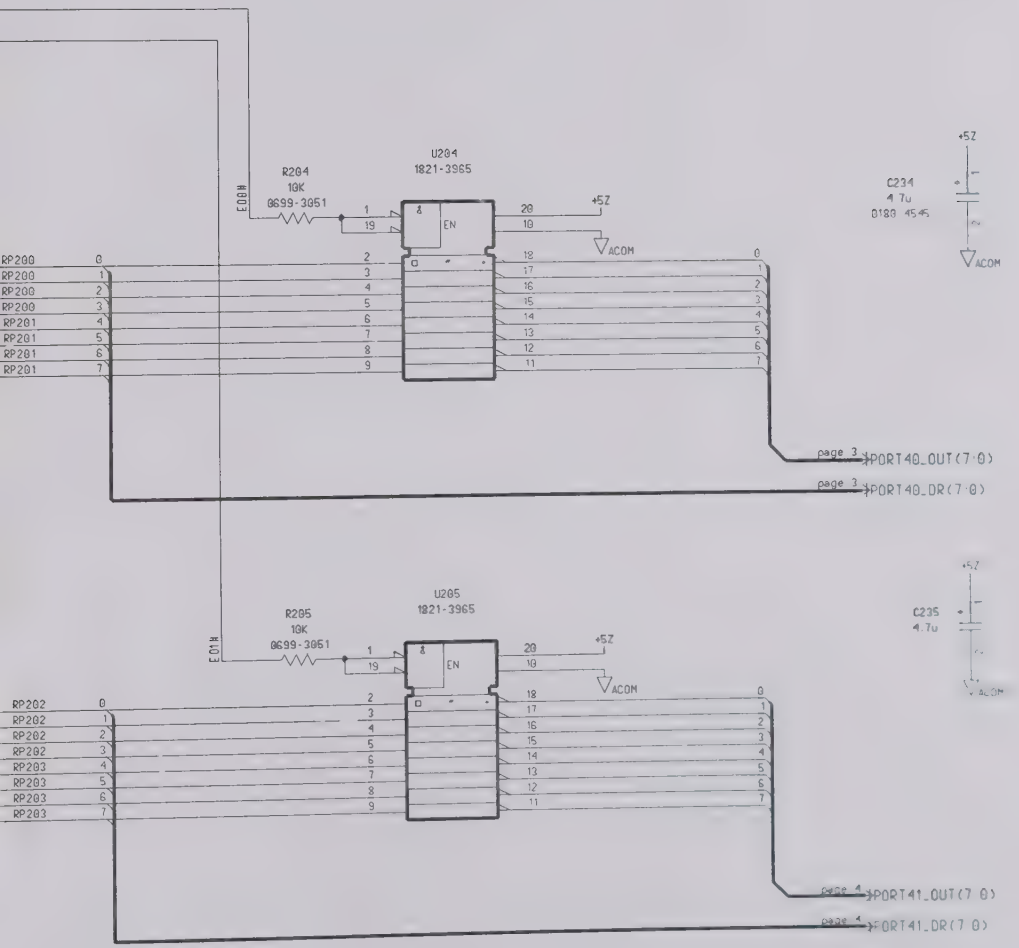


Agilent N2265A Multifunction Module
Schematics -- Sheet 1 of 6

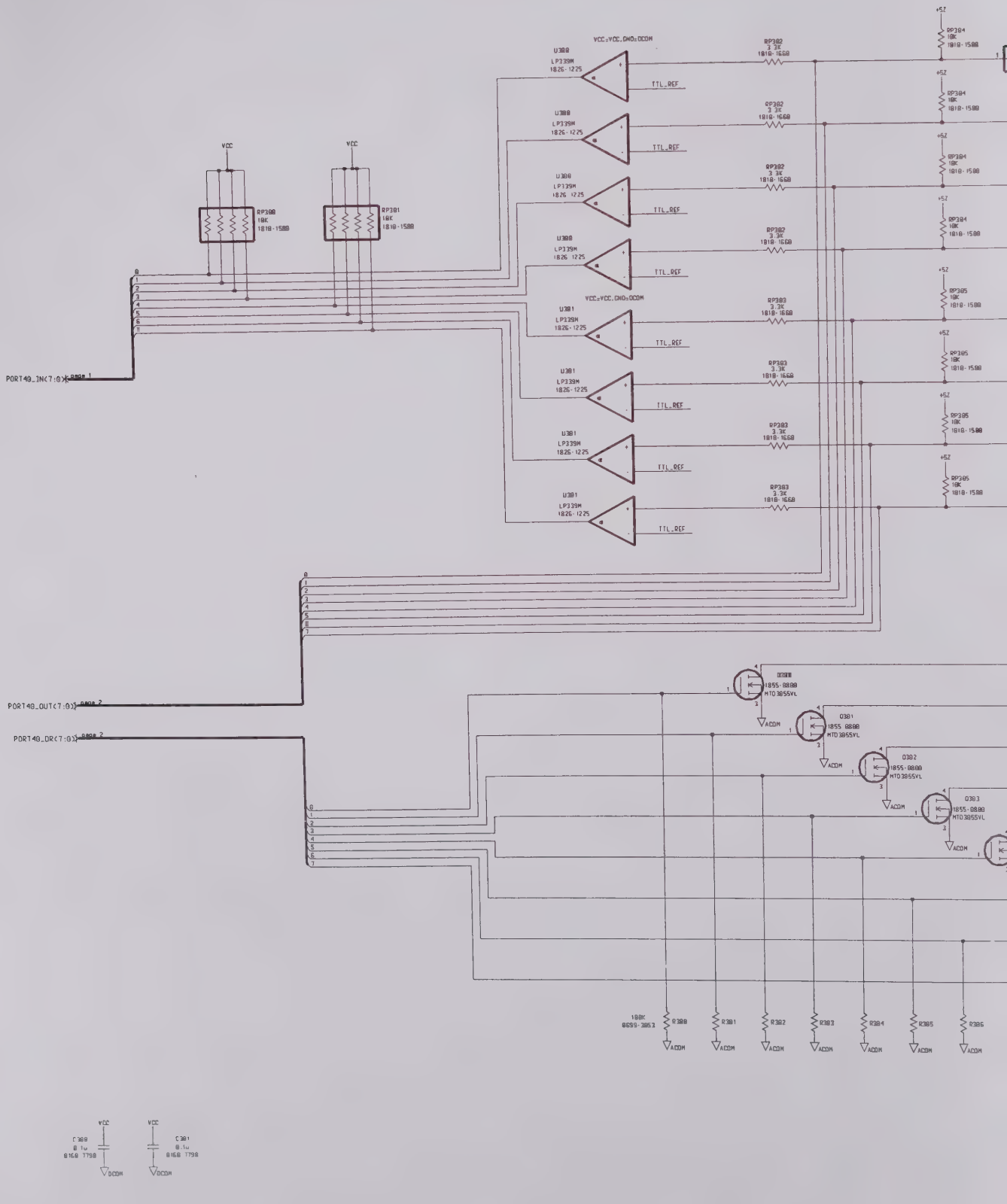
N2265A (Sheet 2) - Output Por

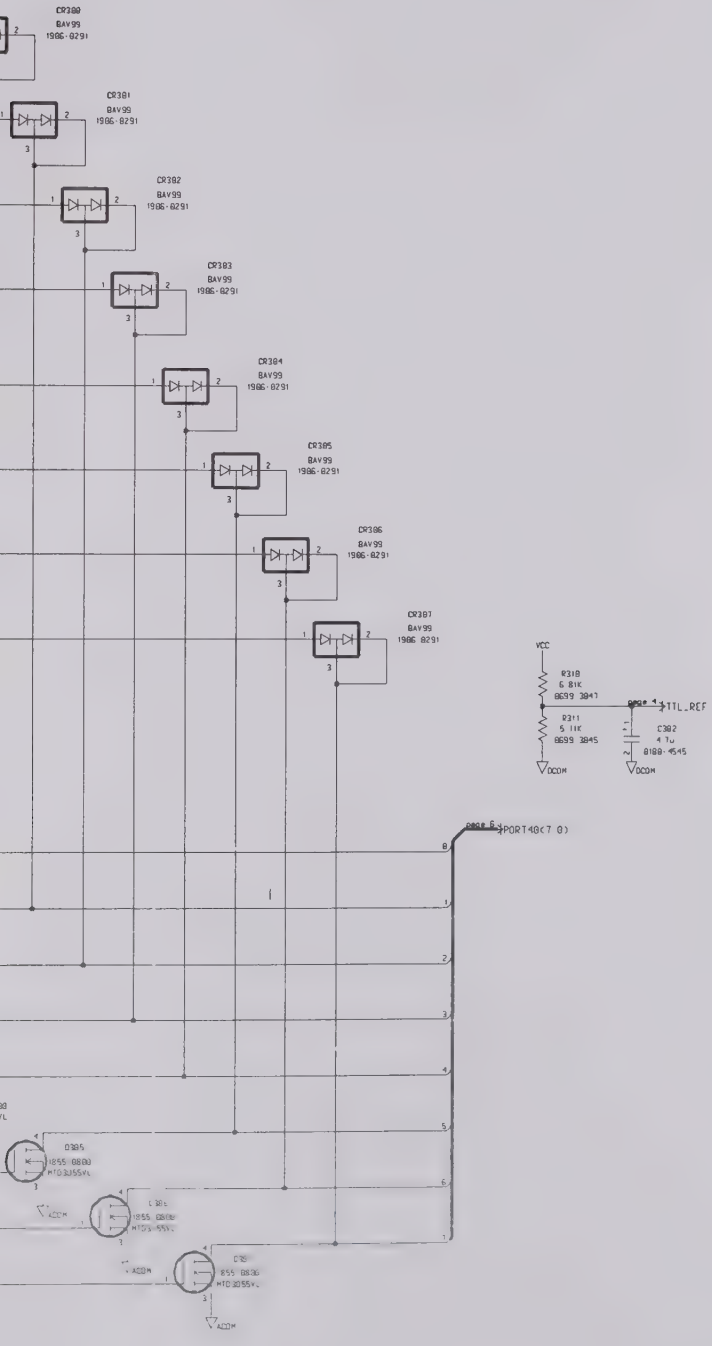


t s


R204
10K
0699-3051
U204
1821-3965
EN
+5Z
ACOM
C234
4.7u
0180-4545
RP200
RP201
page 3 PORT40_OUT(7:0)
page 3 PORT40_DR(7:0)
R205
10K
0699-3051
U205
1821-3965
C235
4.7u
RP202
RP203
page 4 PORT41_OUT(7:0)
page 4 PORT41_DR(7:0)

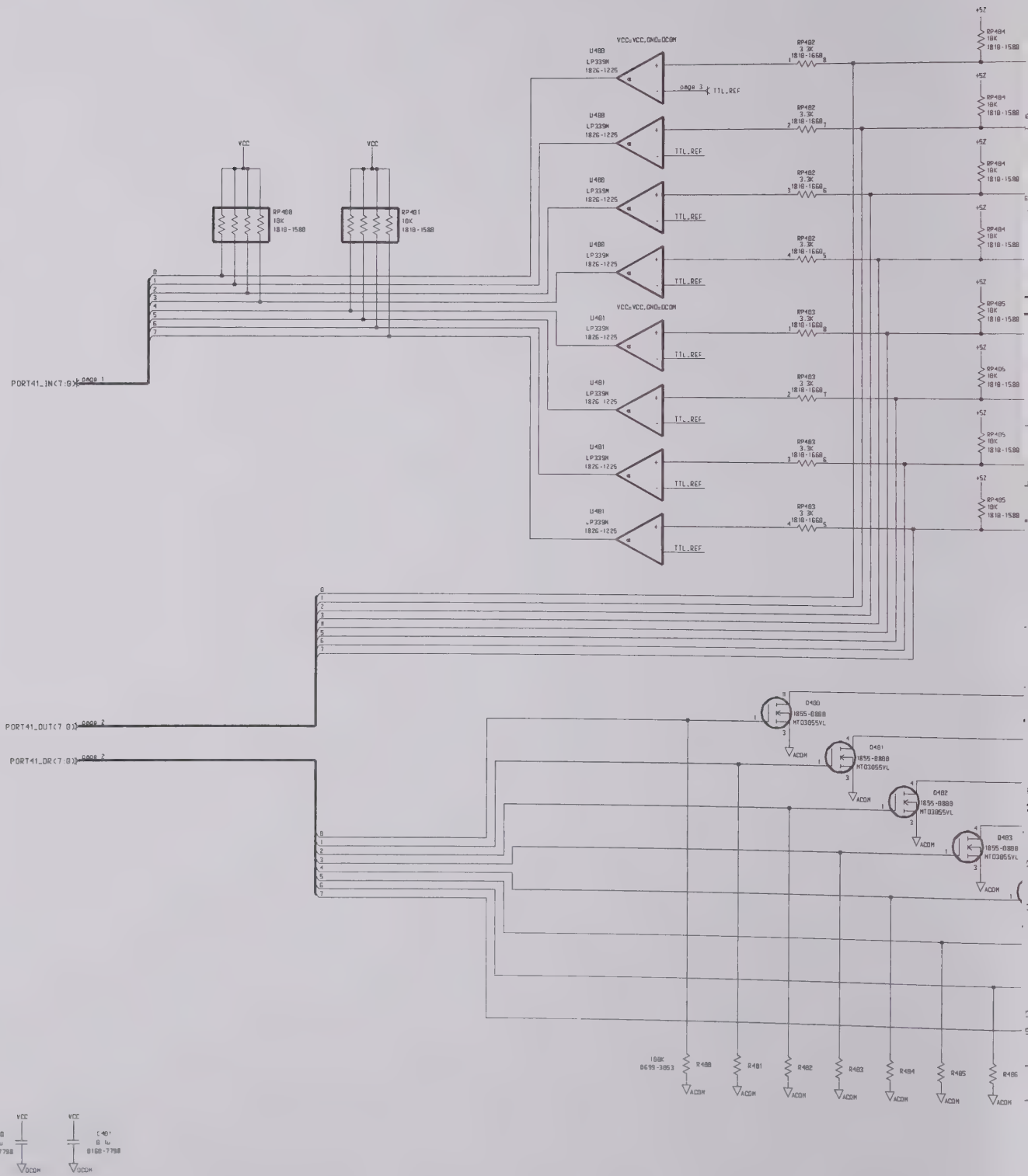
N2265A (Sheet 3) - Port 40

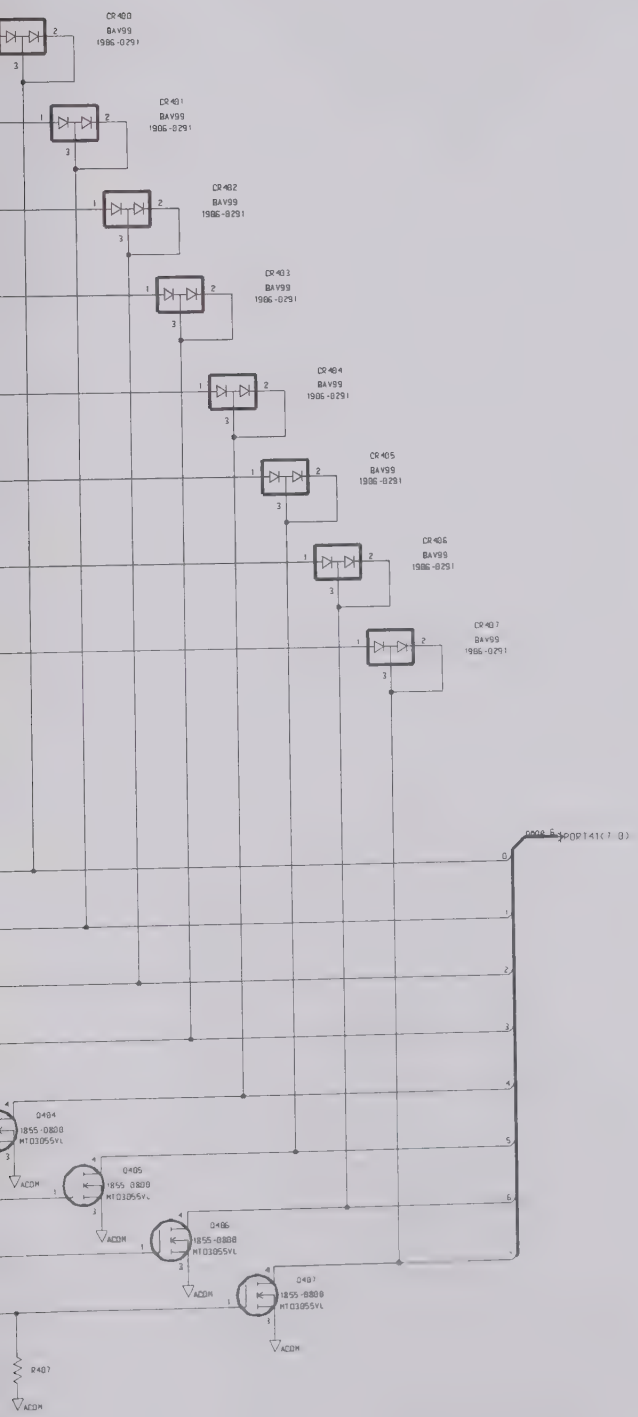




Agilent N2265A Multifunction Module
Schematics -- Sheet 3 of 6

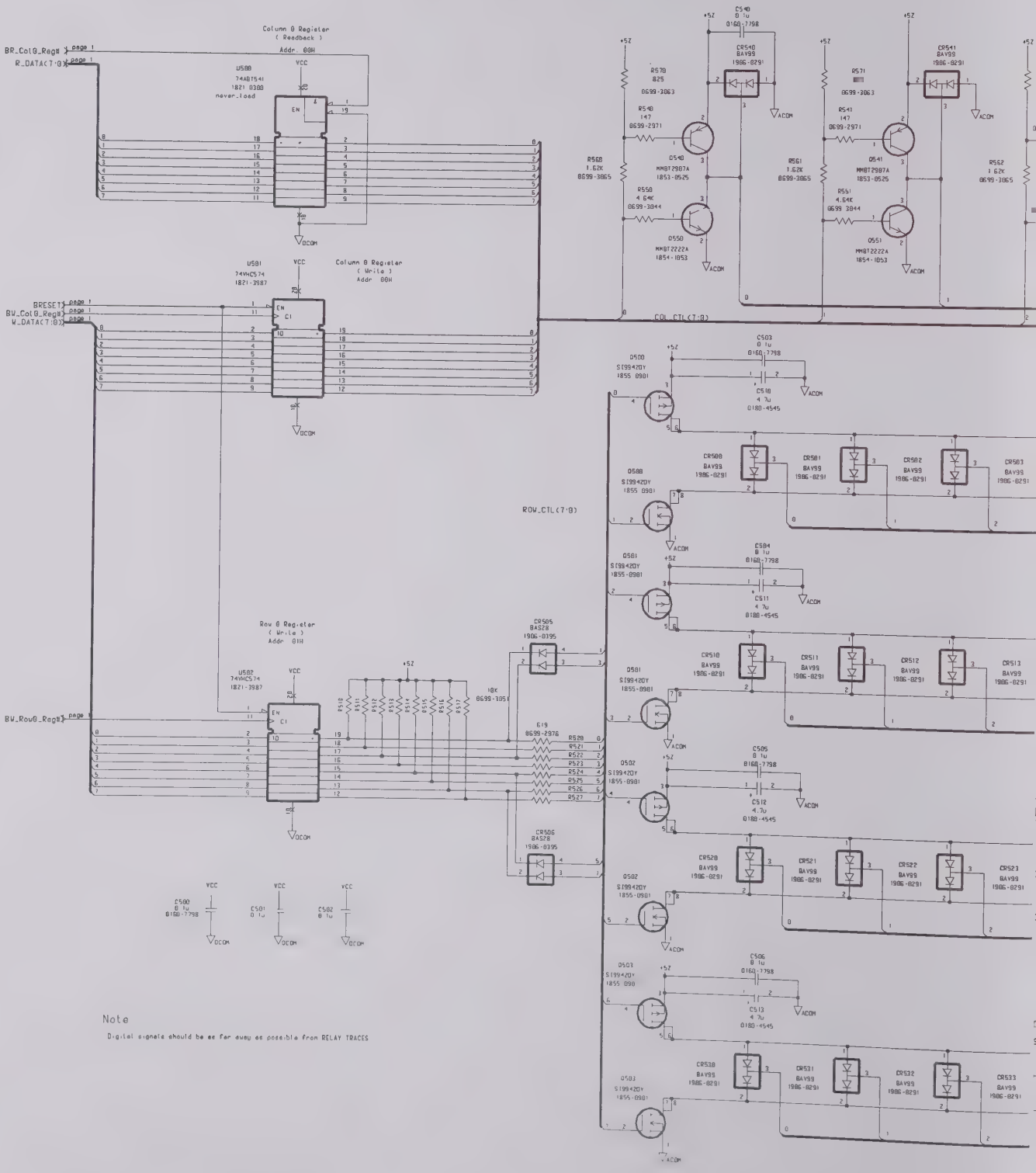
N2265A (Sheet 4) - Port 41

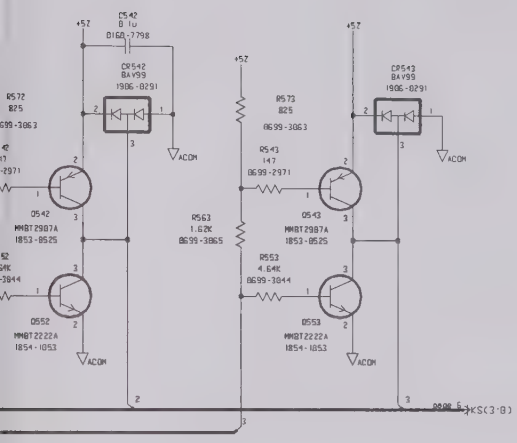


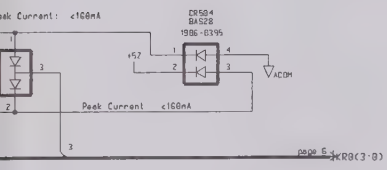


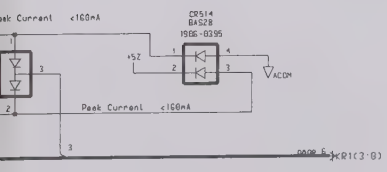
Agilent N2265A Multifunction Module
Schematics -- Sheet 4 of 6

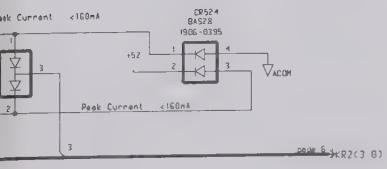
N2265A (Sheet 5) - Relay Drivers

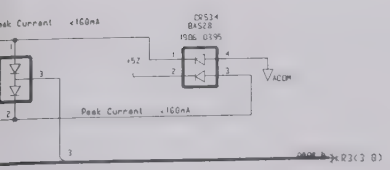






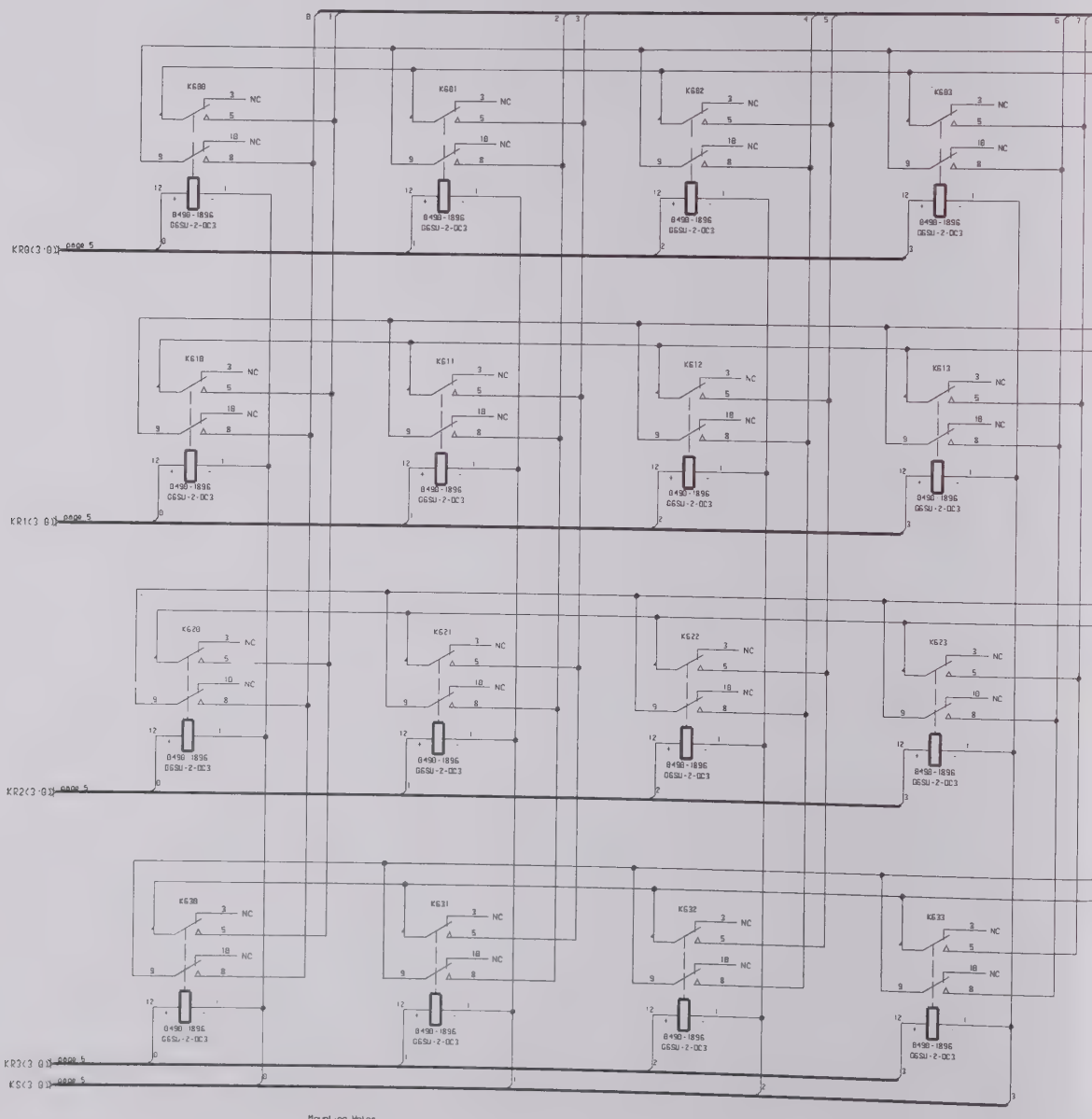


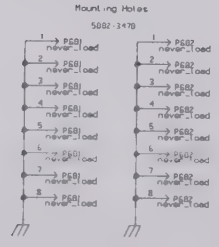




Agilent N2265A Multifunction Module
Schematics -- Sheet 5 of 6

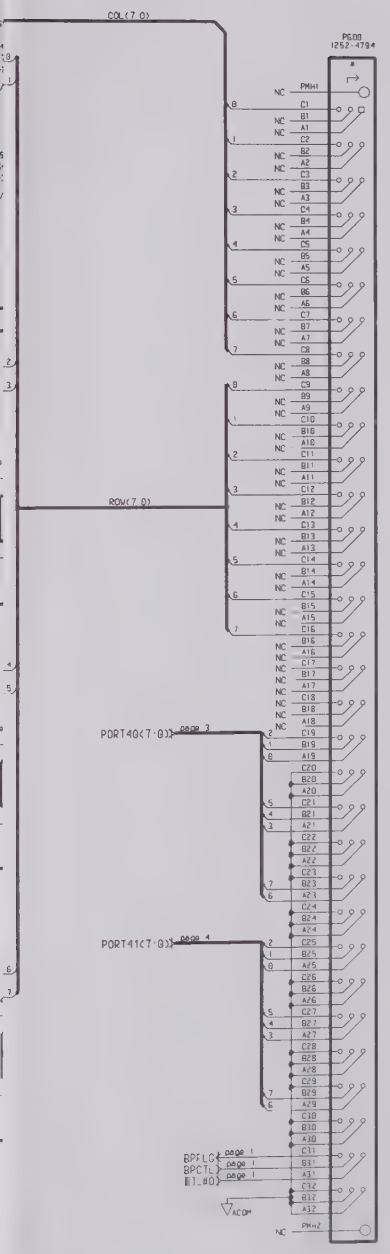
N2265A (Sheet 6) - Relay Matrix and Front End Conn





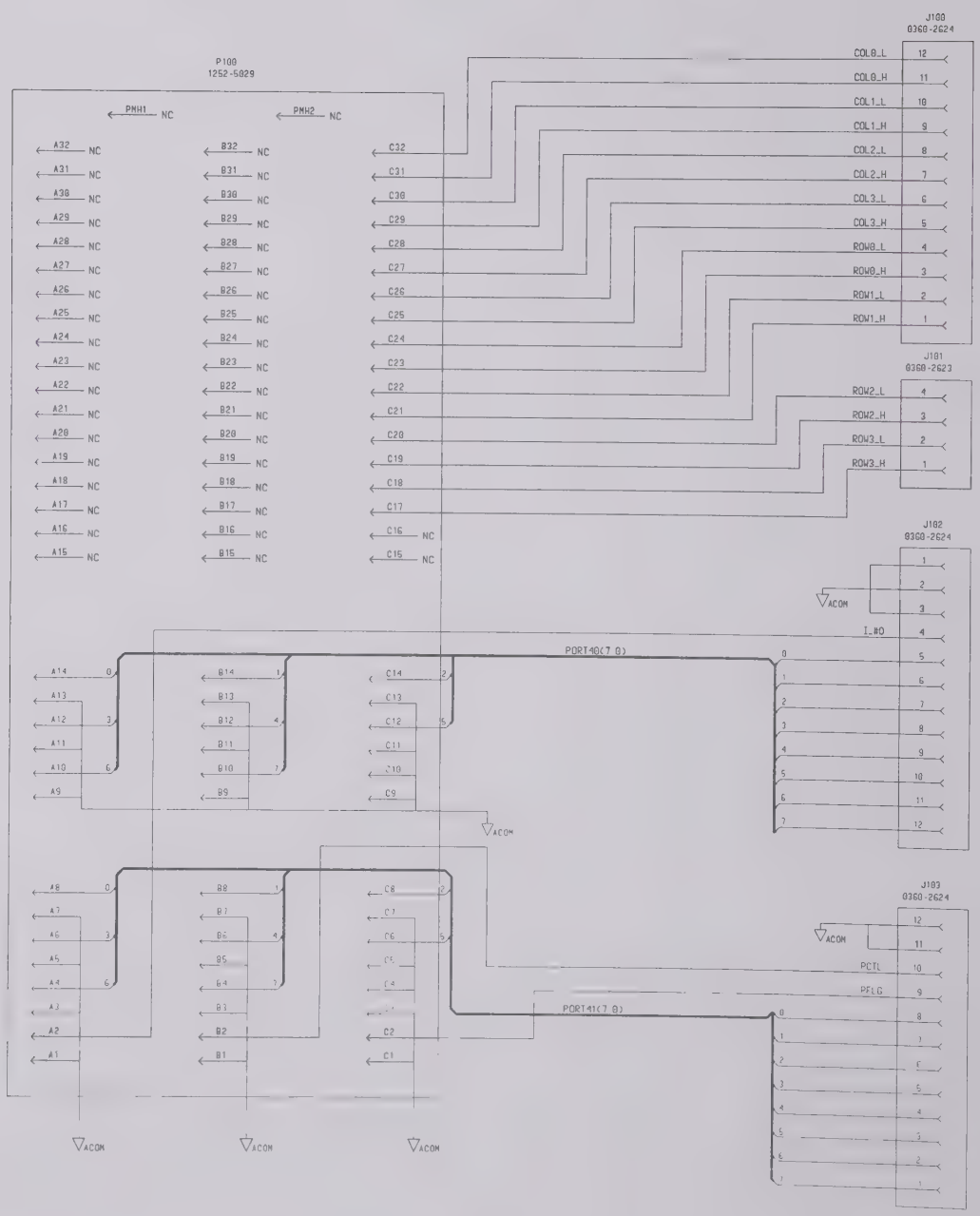
Relay Specification : 1A/200V

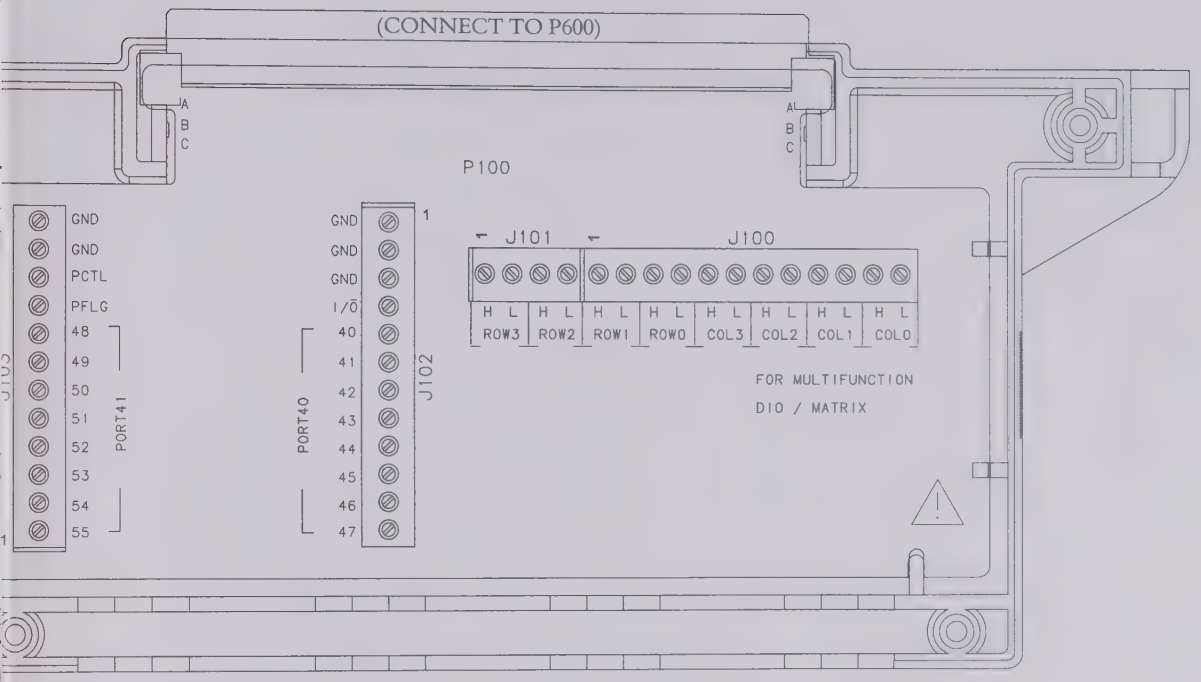
ector

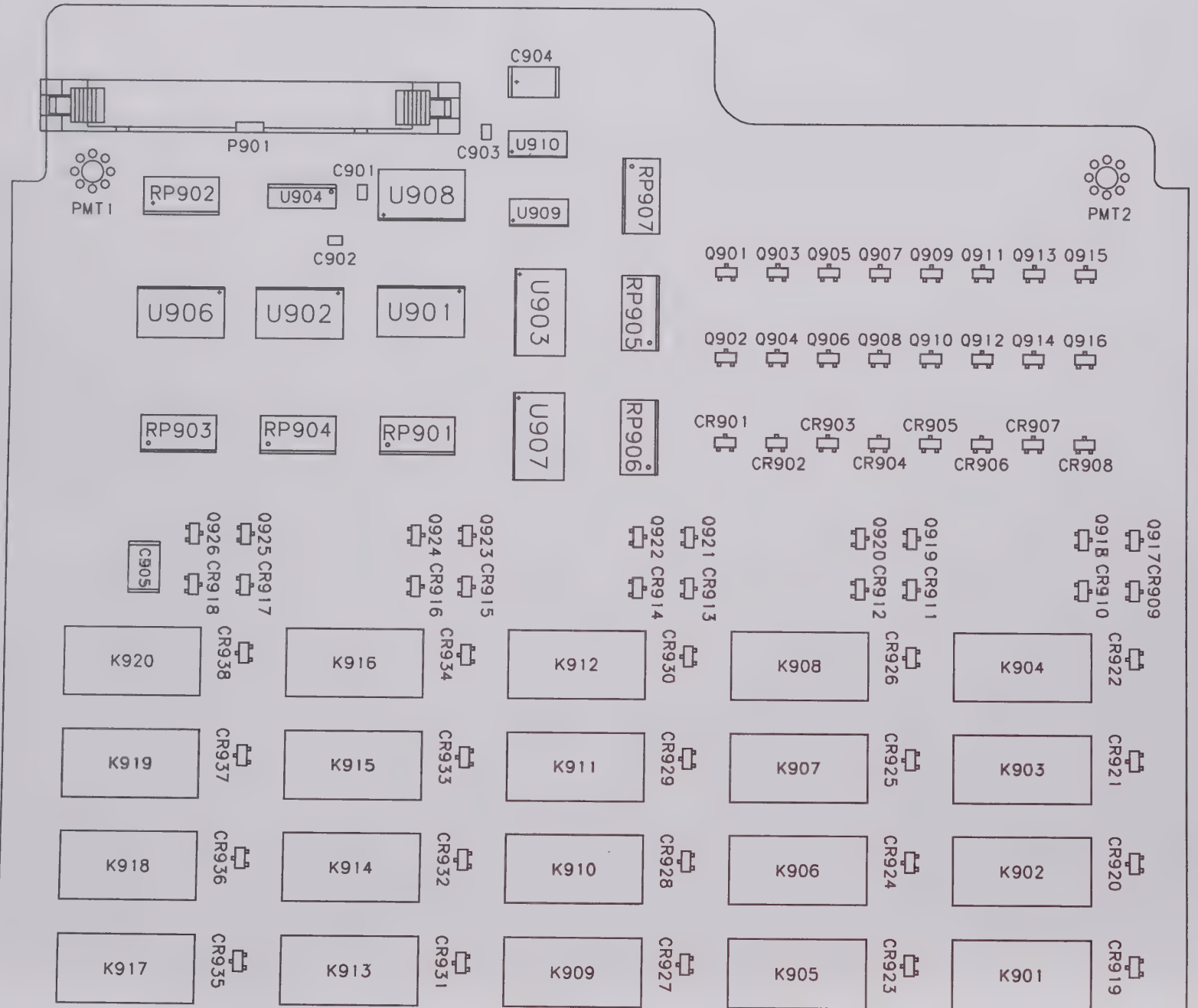


Agilent N2265A Multifunction Module
Schematics -- Sheet 6 of 6

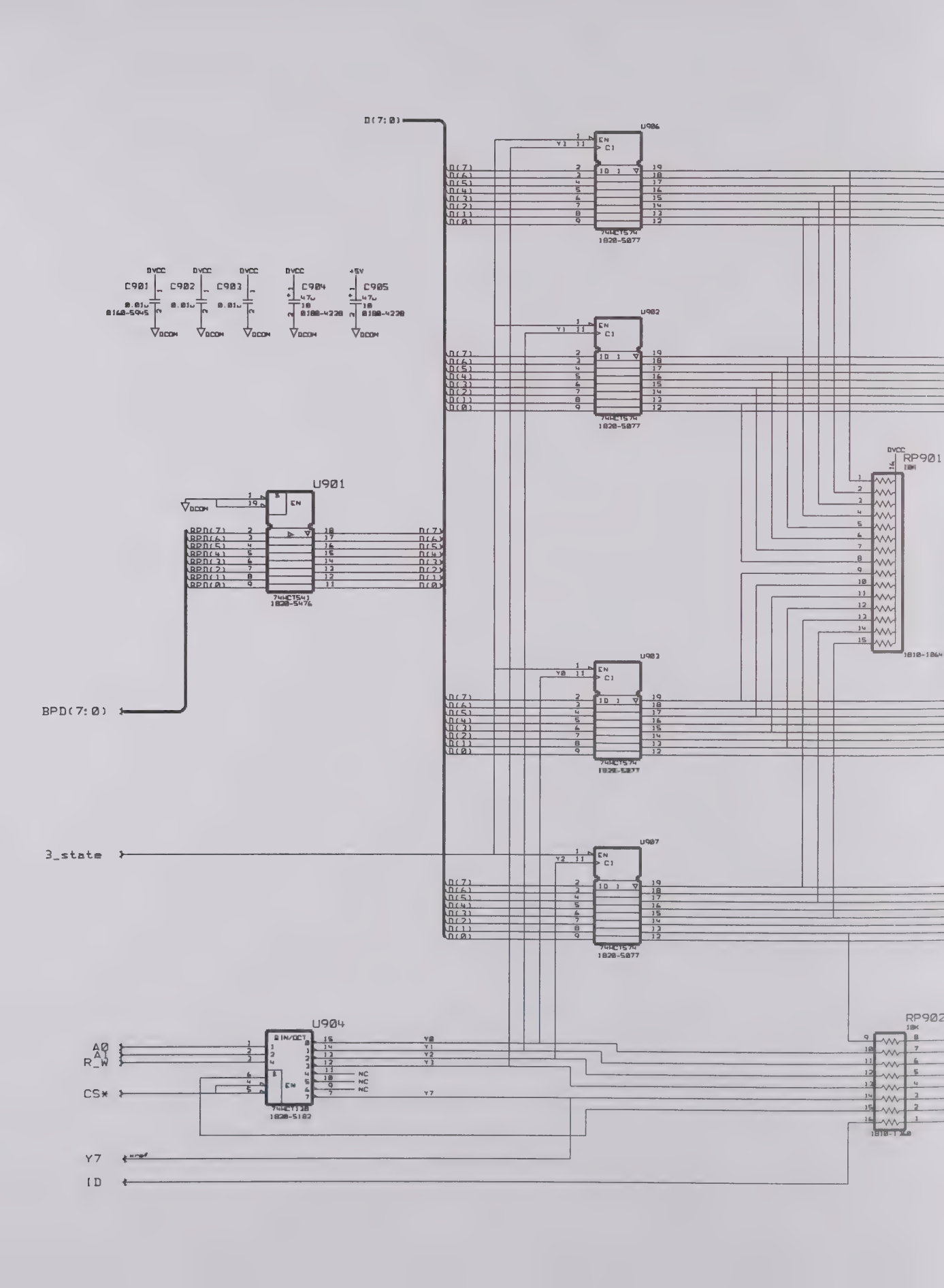
N2295A - N2265A TERMINAL BLOCK

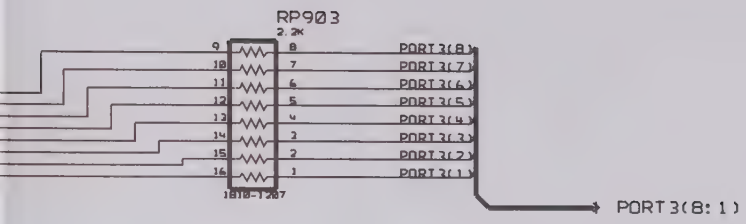


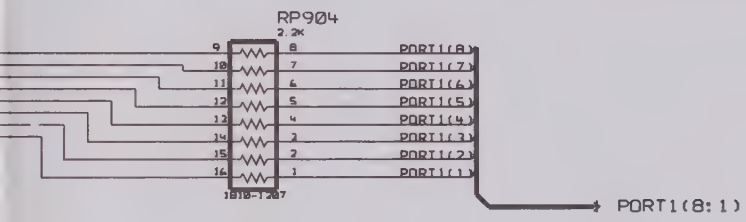

(CONNECT TO P600)
A
B
C
P100
GND
GND
PCTL
PFLG
48
49
50
51
52
53
54
55
PORT41
GND
GND
GND
I/O
40
41
42
43
44
45
46
47
PORT40
J102
J101
J100
H L H L H L H L H L H L H L H L
ROW3 ROW2 ROW1 ROW0 COL3 COL2 COL1 COL0
FOR MULTIFUNCTION
DIO / MATRIX

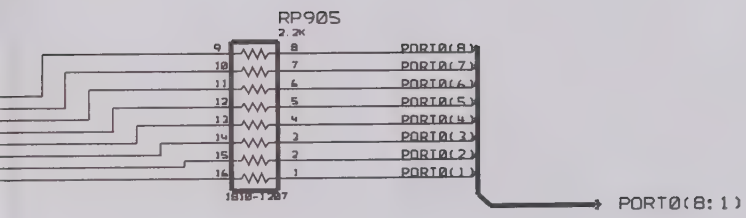

C904
P901
C903
U910
C901
U908
RP907
PMT1
RP902
U904
U909
PMT2
C902
Q901 Q903 Q905 Q907 Q909 Q911 Q913 Q915
U906
U902
U901
U903
RP905
Q902 Q904 Q906 Q908 Q910 Q912 Q914 Q916
RP903
RP904
RP901
U907
RP906
CR901 CR903 CR905 CR907
CR902 CR904 CR906 CR908
Q926 CR918 Q925 CR917
Q924 CR916 Q923 CR915
Q922 CR914 Q921 CR913
Q920 CR912 Q919 CR911
Q918 CR910 Q917 CR909
C905
K920
CR938
K916
CR934
K912
CR930
K908
CR926
K904
CR922
K919
CR937
K915
CR933
K911
CR929
K907
CR925
K903
CR921
K918
CR936
K914
CR932
K910
CR928
K906
CR924
K902
CR920
K917
CR935
K913
CR931
K909
CR927
K905
CR923
K901
CR919

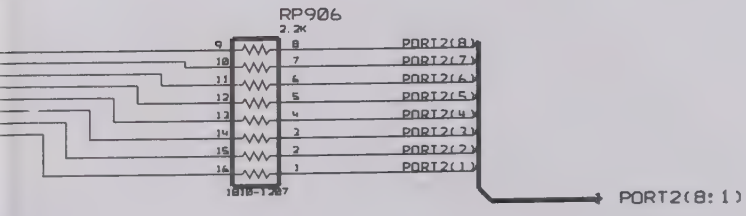
Agilent 44470D 20-Channel MUX Module
Components Locator

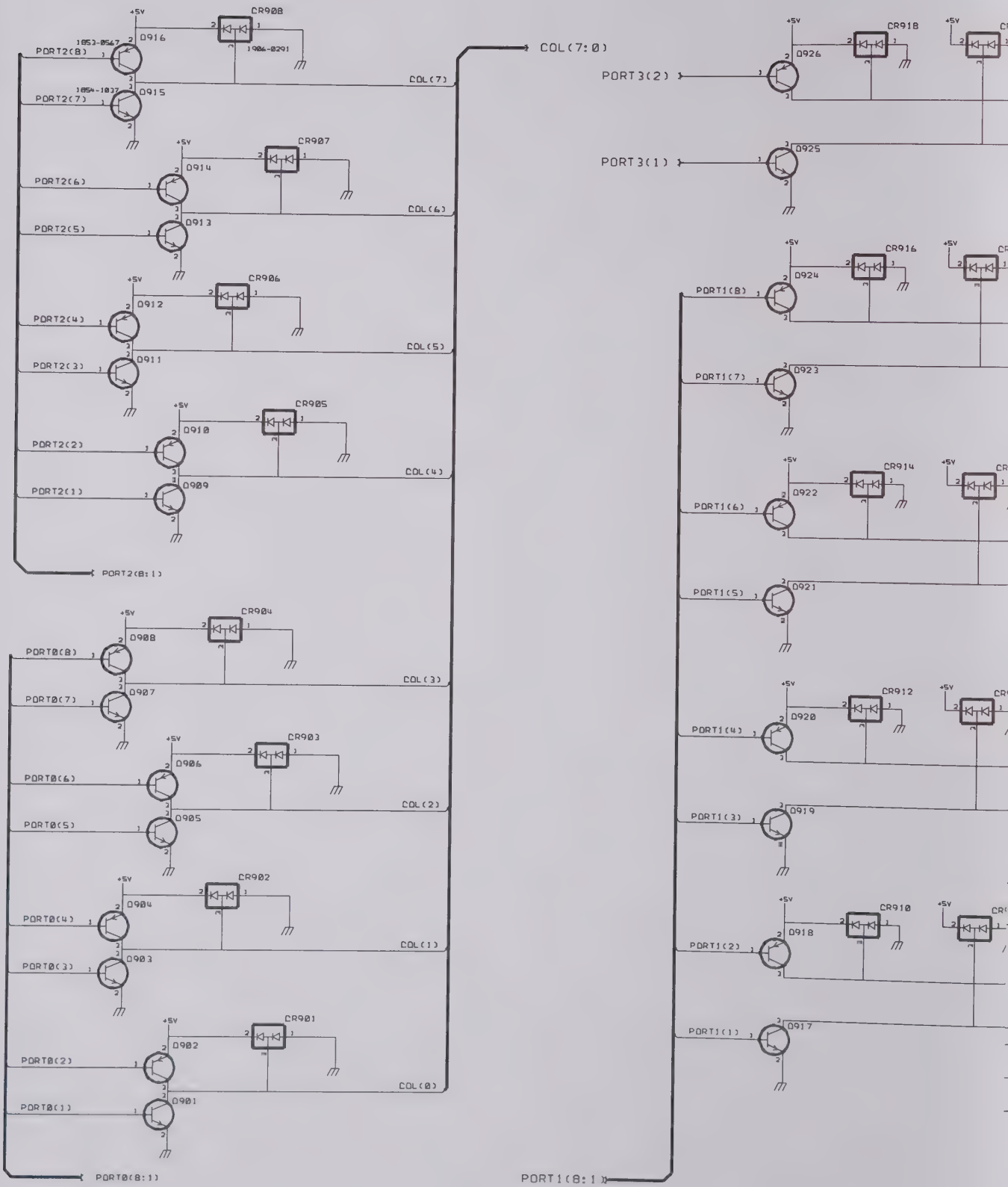

D(7:0)
U906
U902
U903
U907
U901
U904
RP901
RP902
C901
C902
C903
C904
C905
DVCC
+5V
DGND
BPD(7:0)
3_state
A0
A1
R_W
CS*
Y7
ID
74HCT574
1820-5077
74HCT540
1820-5476
74HCT138
1820-5182
1810-1064
NC

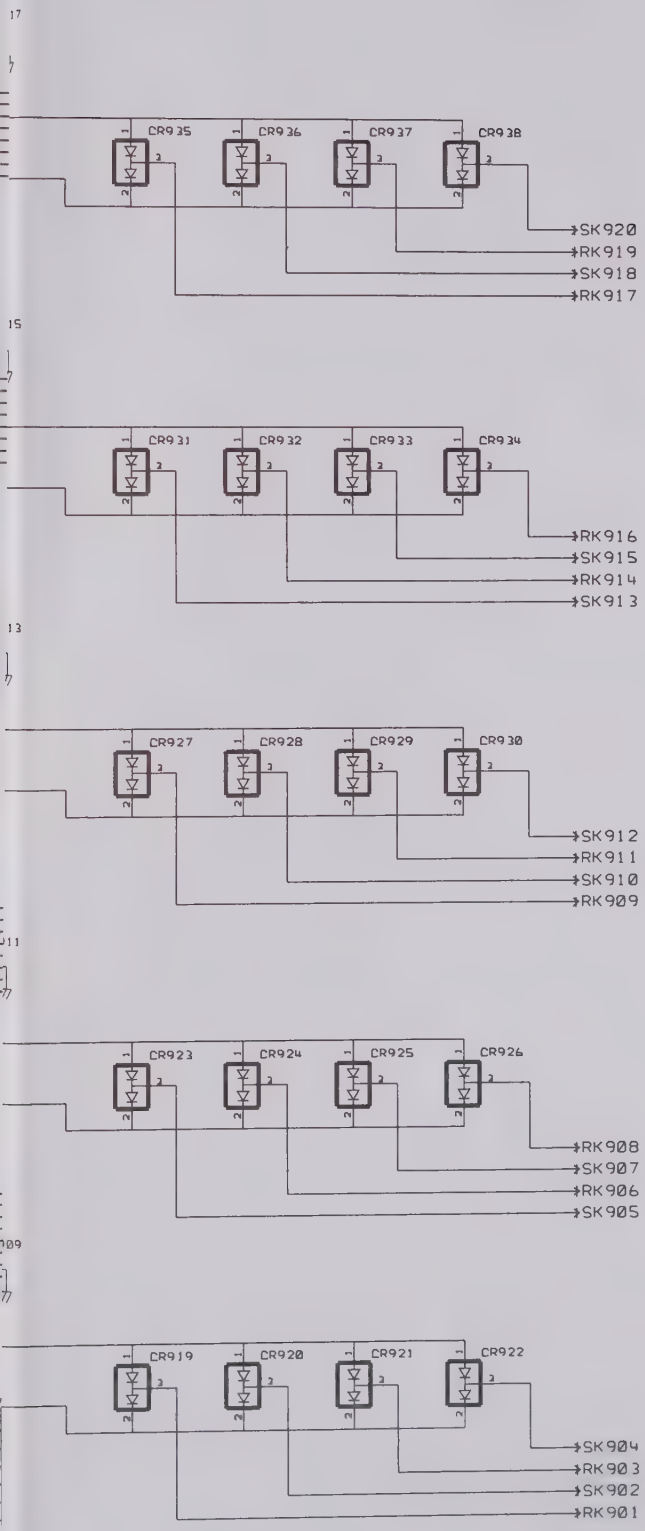

RP903
2.2K
PORT3(8:1)


RP904
2.2K
PORT1(8:1)

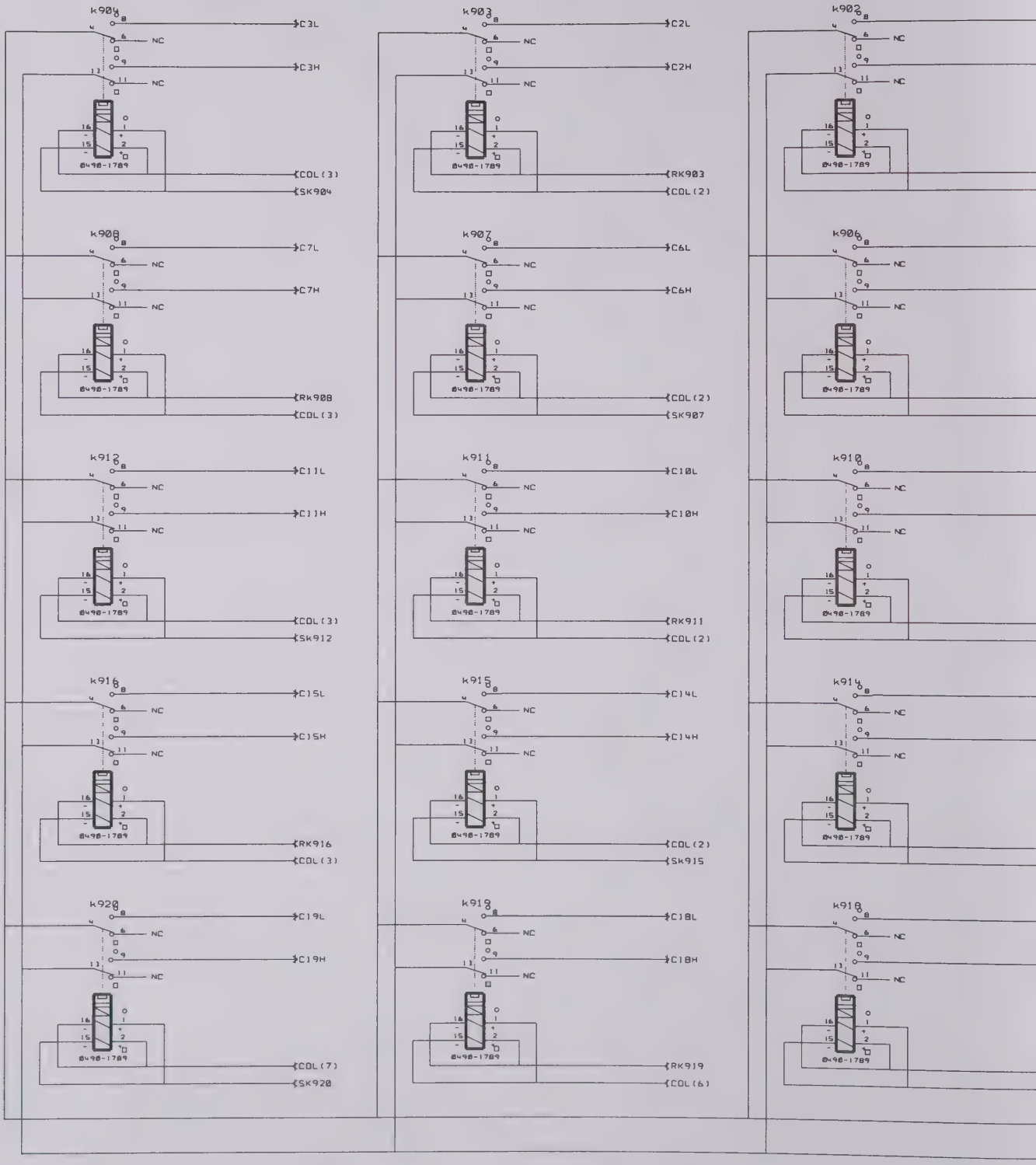

RP905
2.2K
PORT0(8:1)

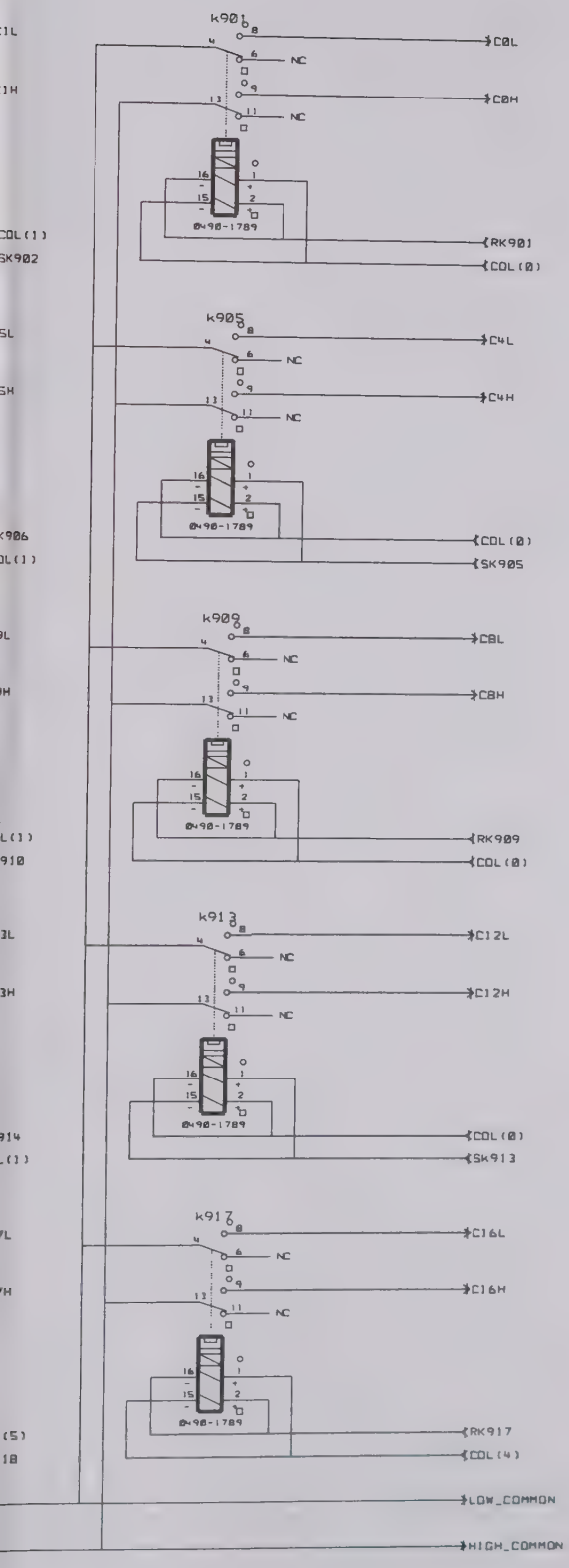

RP906
2.2K
PORT2(8:1)


COL(7:0)
PORT3(2)
PORT3(1)
PORT2(8:1)
PORT0(8:1)
PORT1(8:1)
+5V
CR908
CR907
CR906
CR905
CR904
CR903
CR902
CR901
CR918
CR916
CR914
CR912
CR910
Q916
Q915
Q914
Q913
Q912
Q911
Q910
Q909
Q908
Q907
Q906
Q905
Q904
Q903
Q902
Q901
Q926
Q925
Q924
Q923
Q922
Q921
Q920
Q919
Q918
Q917
PORT2(8)
PORT2(7)
PORT2(6)
PORT2(5)
PORT2(4)
PORT2(3)
PORT2(2)
PORT2(1)
PORT0(8)
PORT0(7)
PORT0(6)
PORT0(5)
PORT0(4)
PORT0(3)
PORT0(2)
PORT0(1)
PORT1(8)
PORT1(7)
PORT1(6)
PORT1(5)
PORT1(4)
PORT1(3)
PORT1(2)
PORT1(1)
COL(7)
COL(6)
COL(5)
COL(4)
COL(3)
COL(2)
COL(1)
COL(0)

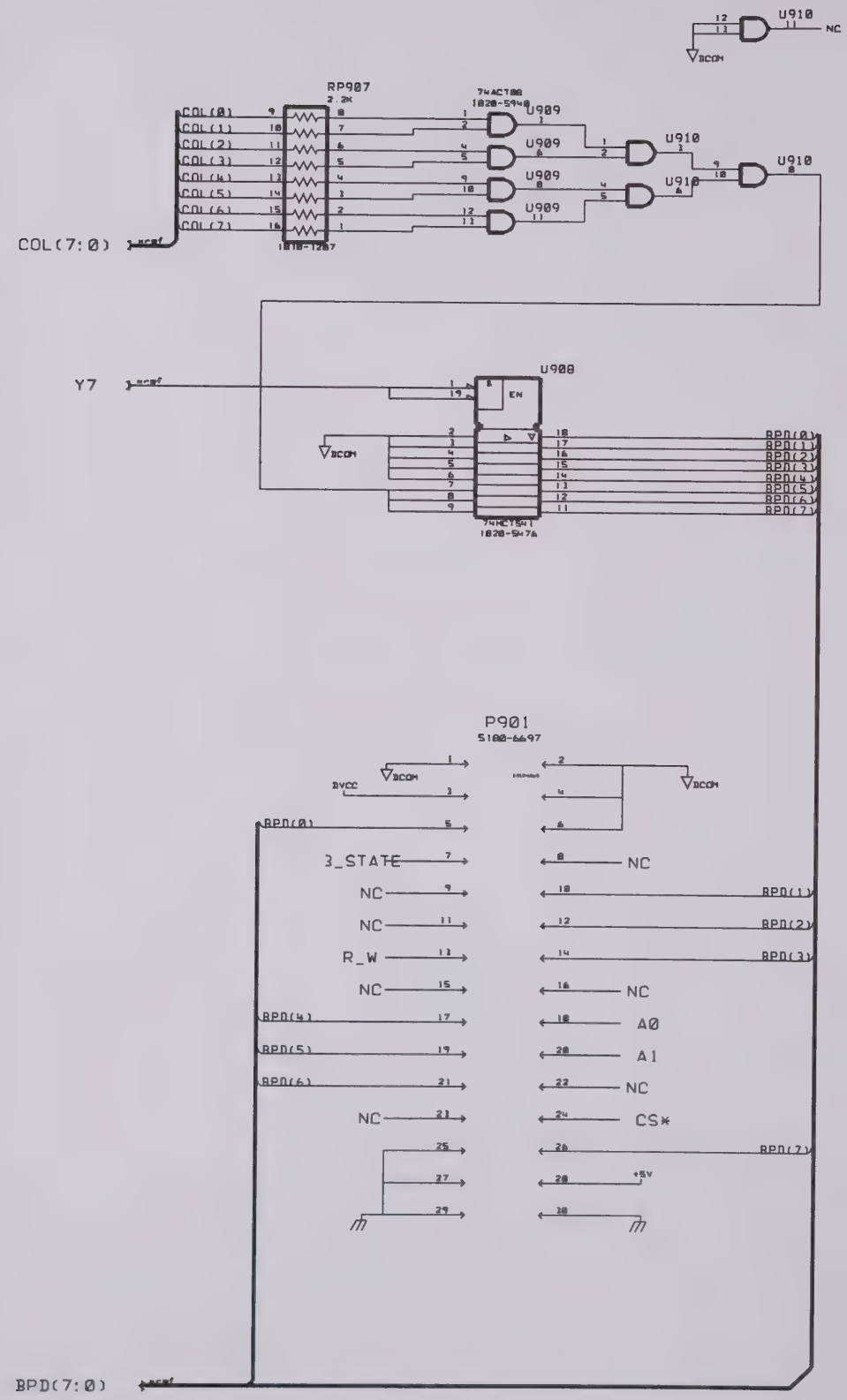


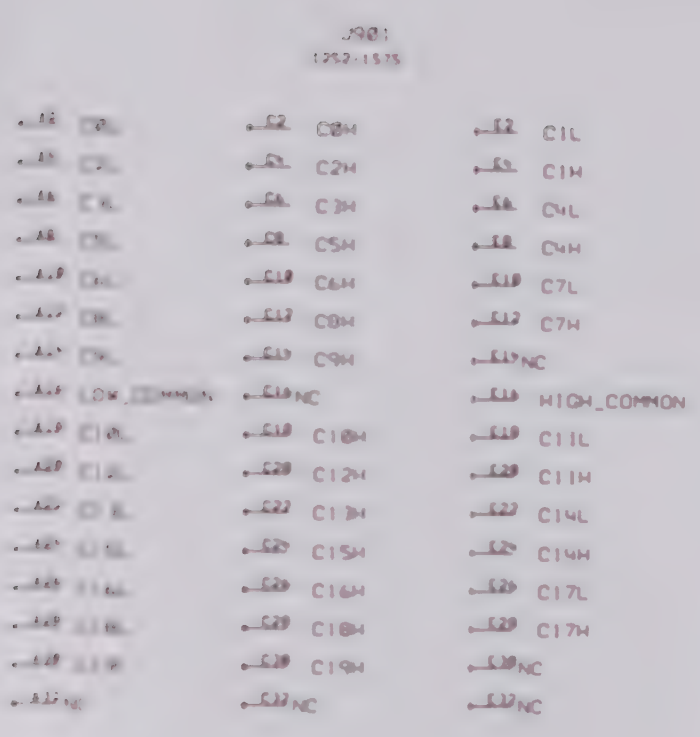
Agilent 44470D 20-Channel MUX Module
Schematics -- Sheet 2 of 4

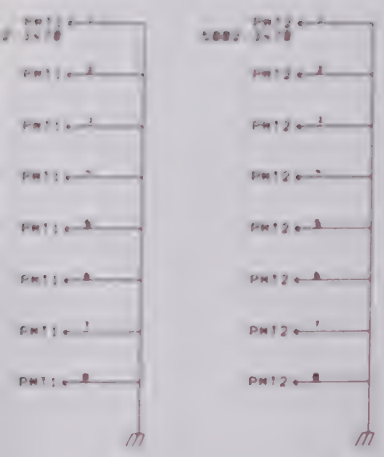

k904
C3L
NC
C3H
NC
0490-1789
COL(3)
SK904
k903
C2L
NC
C2H
NC
0490-1789
RK903
COL(2)
k902
NC
NC
0490-1789
k908
C7L
NC
C7H
NC
0490-1789
Rk908
COL(3)
k907
C6L
NC
C6H
NC
0490-1789
COL(2)
SK907
k906
NC
NC
0490-1789
k912
C11L
NC
C11H
NC
0490-1789
COL(3)
Sk912
k911
C10L
NC
C10H
NC
0490-1789
RK911
COL(2)
k910
NC
NC
0490-1789
k916
C15L
NC
C15H
NC
0490-1789
RK916
COL(3)
k915
C14L
NC
C14H
NC
0490-1789
COL(2)
Sk915
k914
NC
NC
0490-1789
k920
C19L
NC
C19H
NC
0490-1789
COL(7)
SK920
k918
C18L
NC
C18H
NC
0490-1789
RK919
COL(6)
k918
NC
NC
0490-1789

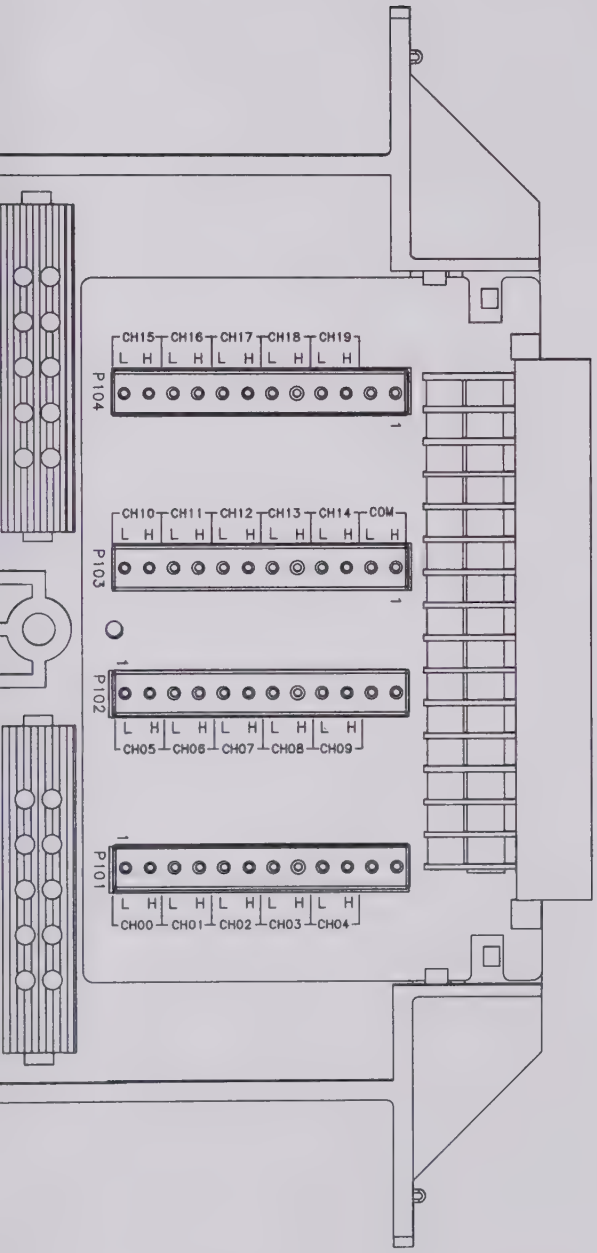


Agilent 44470D 20-Channel MUX Module
Schematics -- Sheet 3 of 4


U910
NC
DCOM
RP907
2.2K
74ACT88
1820-5948
COL(0)
COL(1)
COL(2)
COL(3)
COL(4)
COL(5)
COL(6)
COL(7)
U909
U910
U910
COL(7:0)
Y7
U908
EN
74HCT541
1820-5476
BPD(0)
BPD(1)
BPD(2)
BPD(3)
BPD(4)
BPD(5)
BPD(6)
BPD(7)
P901
5180-6697
DVCC
DCOM
3_STATE
NC
R_W
A0
A1
CS*
+5V
BPD(7:0)


C0H
C2H
C3H
C5H
C6H
C8H
C9H
NC
C10H
C12H
C13H
C15H
C16H
C18H
C19H
NC
C1L
C1H
C4L
C4H
C7L
C7H
NC
HIGH_COMMON
C11L
C11H
C14L
C14H
C17L
C17H
NC
NC




CH15 CH16 CH17 CH18 CH19
L H L H L H L H L H
P104
CH10 CH11 CH12 CH13 CH14 COM
L H L H L H L H L H L H
P103
P102
L H L H L H L H L H
CH05 CH06 CH07 CH08 CH09
P101
L H L H L H L H L H
CH00 CH01 CH02 CH03 CH04

J101
1252-1577

0360-2624

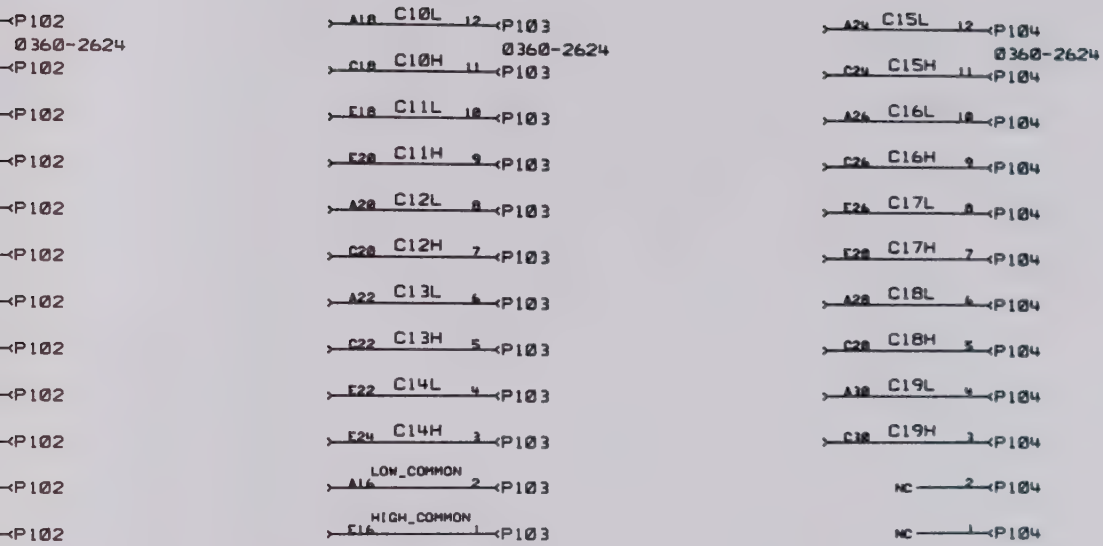
A2	C0L	1	P101
C2	C0H	2	P101
E2	C1L	3	P101
E4	C1H	4	P101
A4	C2L	5	P101
C4	C2H	6	P101
A6	C3L	7	P101
C6	C3H	8	P101
E6	C4L	9	P101
E8	C4H	10	P101
NC		11	P101
NC		12	P101

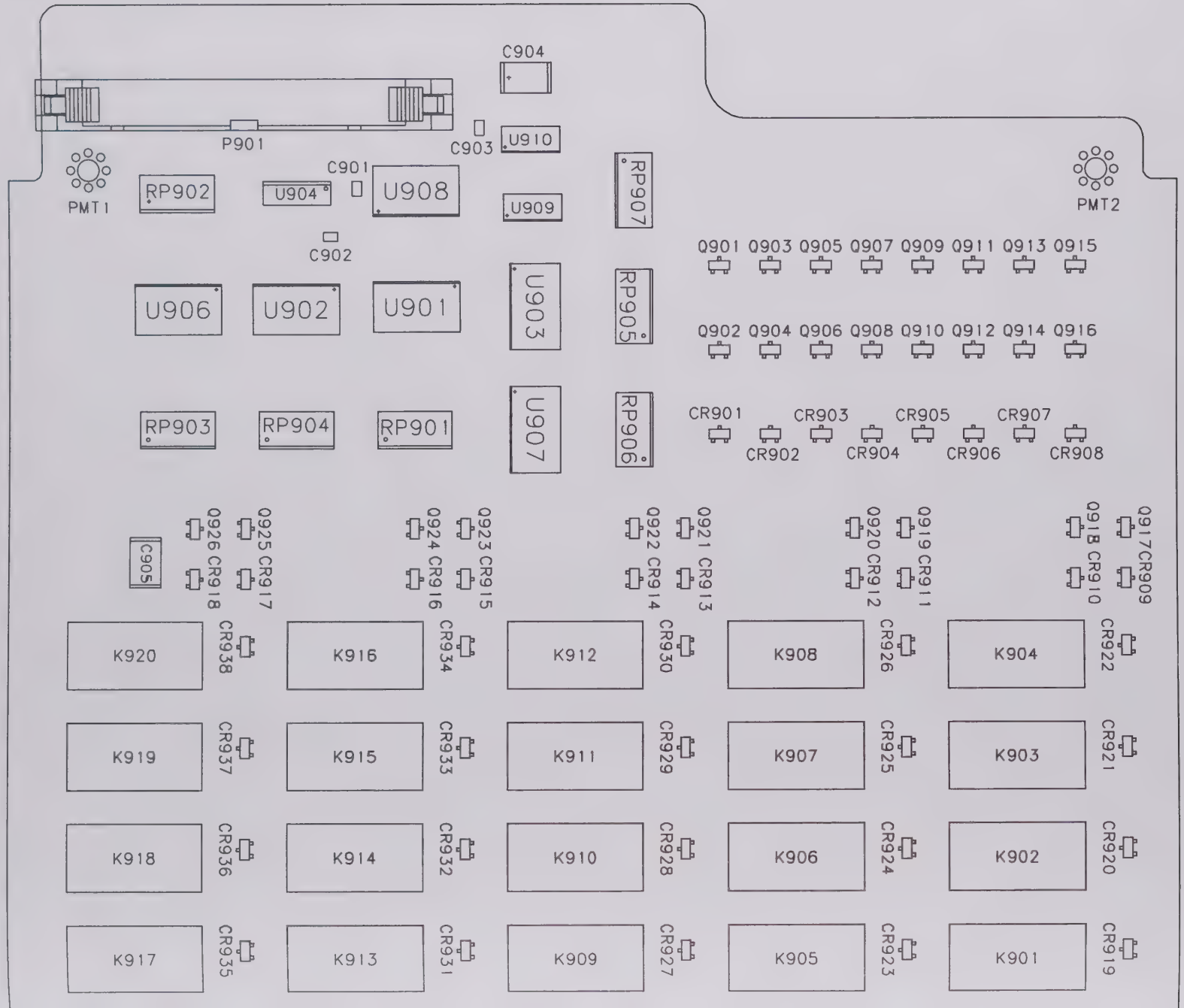
A8	C5L	
C8	C5H	
A10	C6L	
C10	C6H	
E10	C7L	
E12	C7H	
A12	C8L	
C12	C8H	
A14	C9L	
C14	C9H	
NC		
NC		

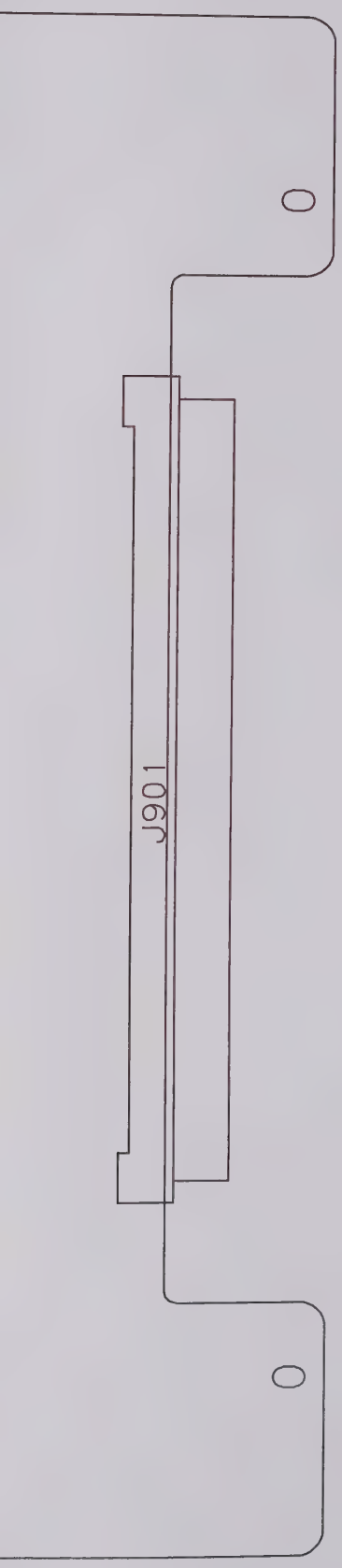
A32 NC C16 NC E14 NC

C32 NC E30 NC

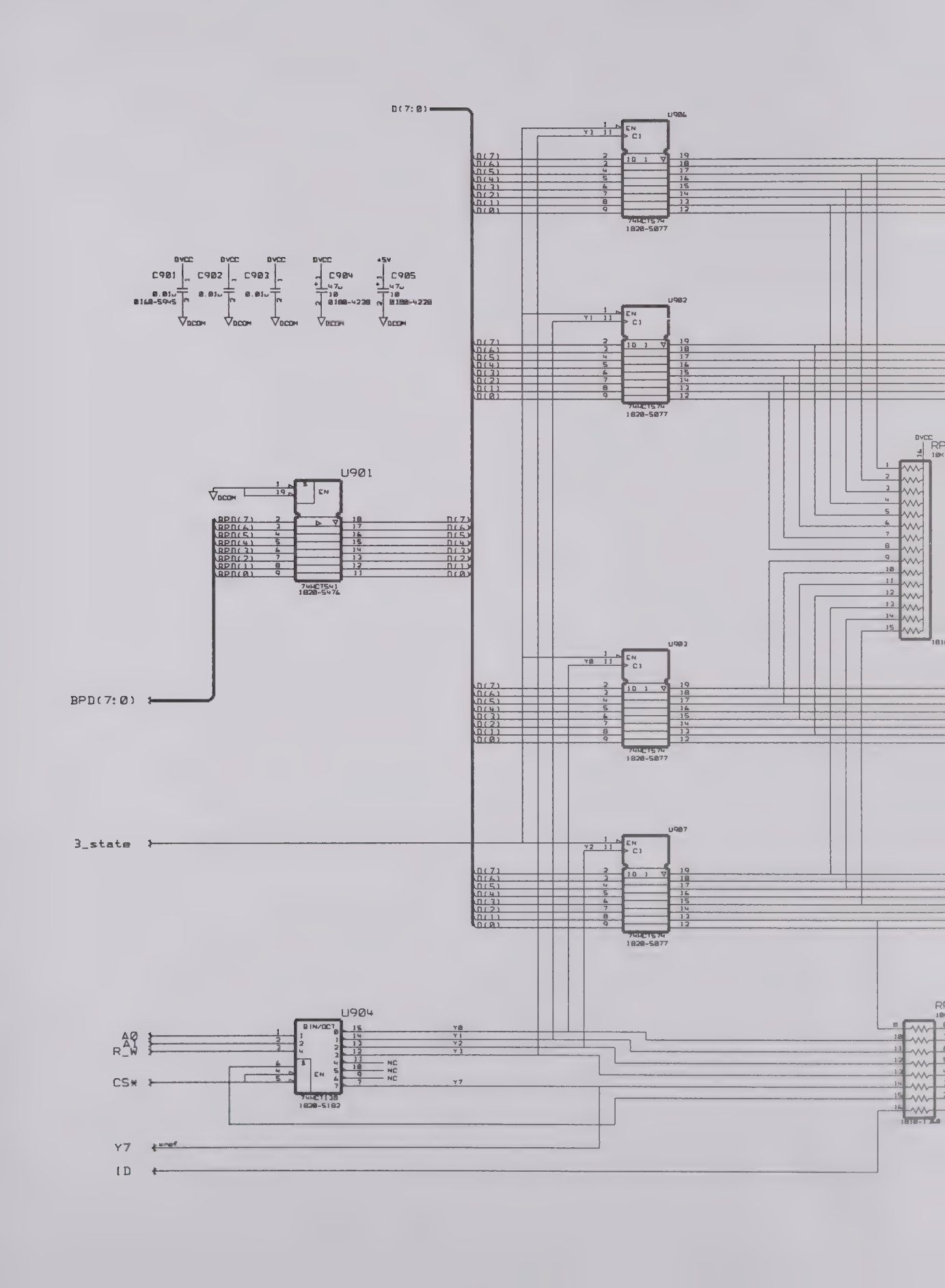
E32 NC


P102
0360-2624
P102
P102
P102
P102
P102
P102
P102
P102
P102
P102
P102
A18 C10L 12 P103
0360-2624
C10H 11 P103
E18 C11L 10 P103
E20 C11H 9 P103
A20 C12L 8 P103
C20 C12H 7 P103
A22 C13L 6 P103
C22 C13H 5 P103
E22 C14L 4 P103
E24 C14H 3 P103
LOW_COMMON
A16 2 P103
HIGH_COMMON
E16 1 P103
A24 C15L 12 P104
0360-2624
C24 C15H 11 P104
A26 C16L 10 P104
C26 C16H 9 P104
E26 C17L 8 P104
E28 C17H 7 P104
A28 C18L 6 P104
C28 C18H 5 P104
A30 C19L 4 P104
C30 C19H 3 P104
NC 2 P104
NC 1 P104


C904
P901
C903
U910
C901
U908
RP907
PMT1
RP902
U904
U909
PMT2
C902
Q901 Q903 Q905 Q907 Q909 Q911 Q913 Q915
U906
U902
U901
U903
RP905
Q902 Q904 Q906 Q908 Q910 Q912 Q914 Q916
RP903
RP904
RP901
U907
RP906
CR901 CR903 CR905 CR907
CR902 CR904 CR906 CR908
Q926 CR918 Q925 CR917
Q924 CR916 Q923 CR915
Q922 CR914 Q921 CR913
Q920 CR912 Q919 CR911
Q918 CR910 Q917 CR909
C905
K920 CR938
K916 CR934
K912 CR930
K908 CR926
K904 CR922
K919 CR937
K915 CR933
K911 CR929
K907 CR925
K903 CR921
K918 CR936
K914 CR932
K910 CR928
K906 CR924
K902 CR920
K917 CR935
K913 CR931
K909 CR927
K905 CR923
K901 CR919



Agilent 44471D 20-Channel GP Relay Module
Components Locator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U901
U903
U907
U904
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DCOM
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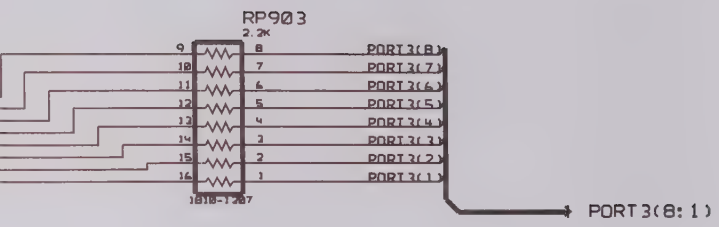
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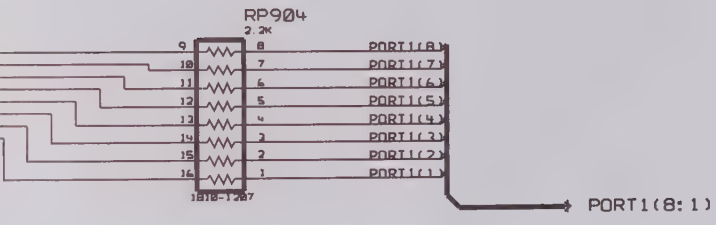
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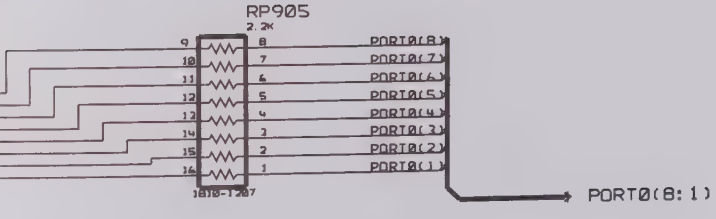
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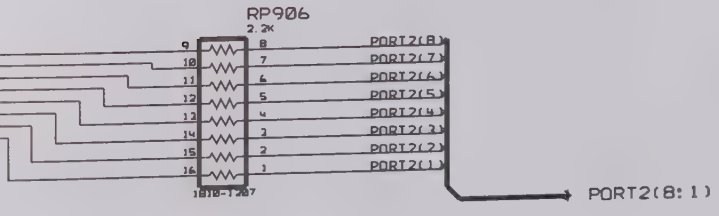
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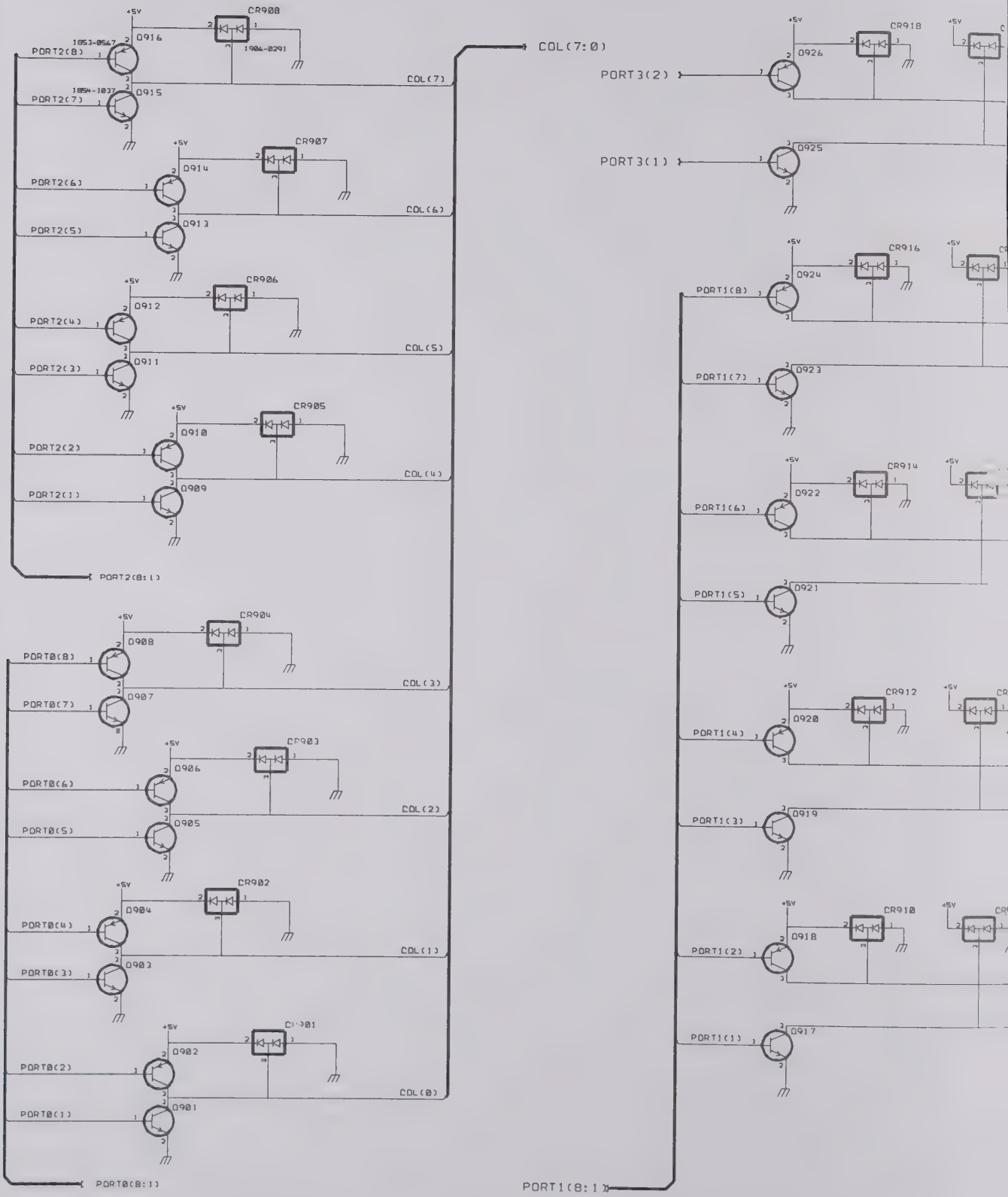
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CR906
CR905
CR904
CR903
CR902
CR901
CR918
CR916
CR914
CR912
CR910
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Q915
Q914
Q913
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Q911
Q910
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Q906
Q905
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Q902
Q901
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Q924
Q923
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1854-1027
1906-0291
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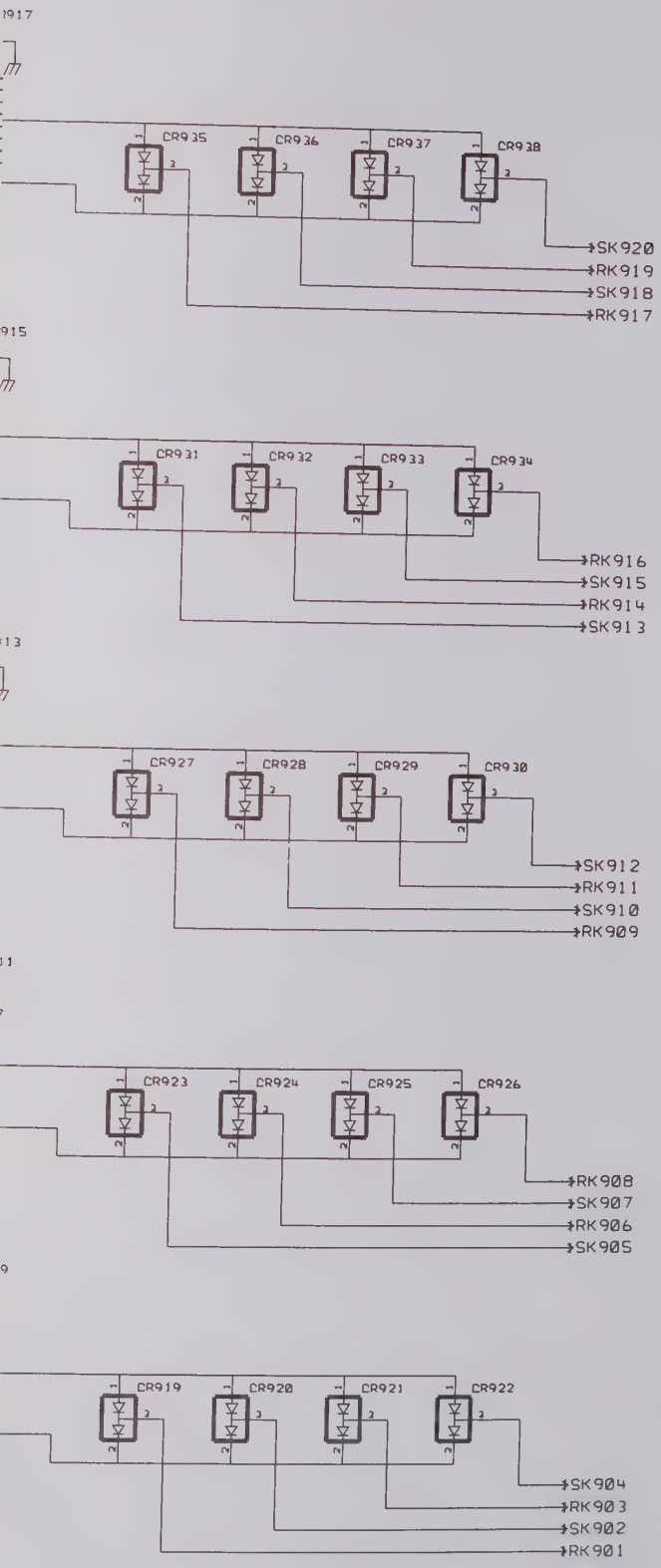
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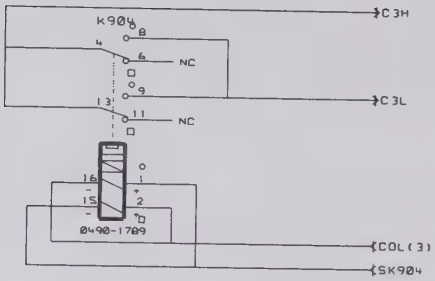
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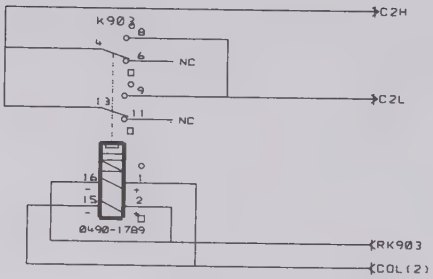
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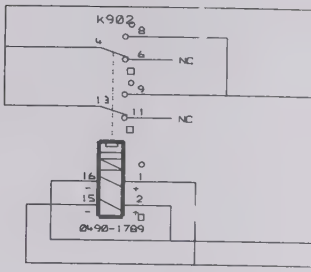
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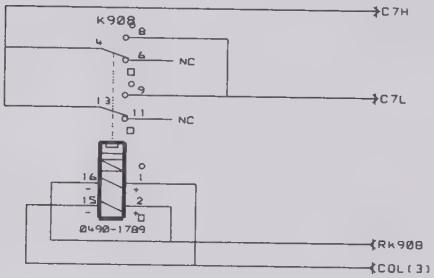
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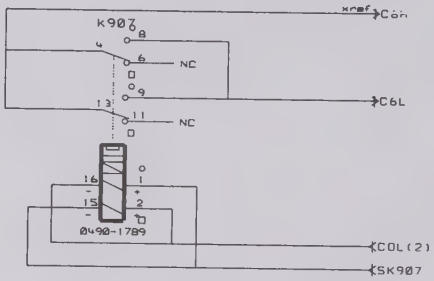
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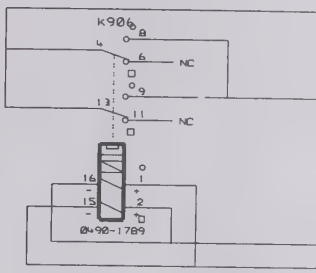
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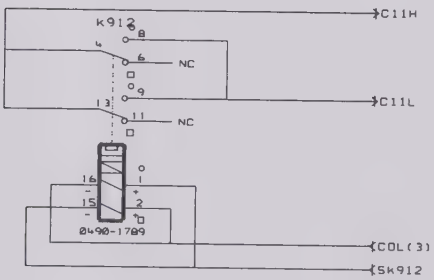
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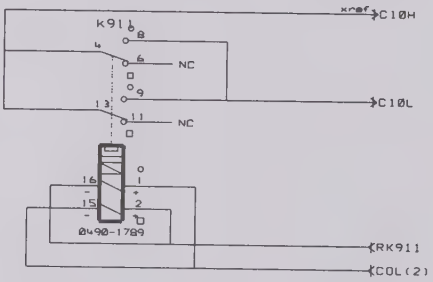
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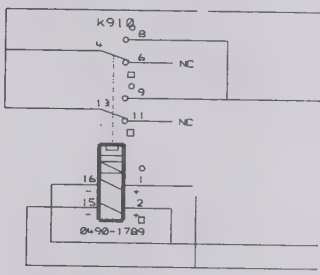
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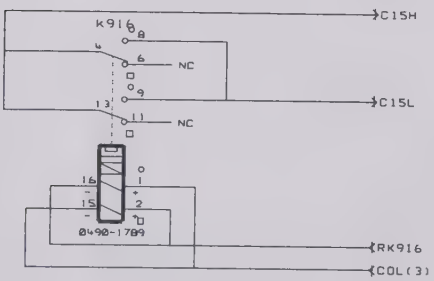
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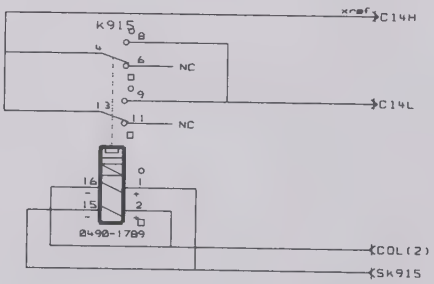
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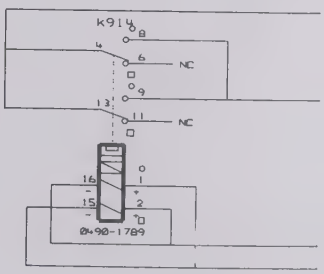
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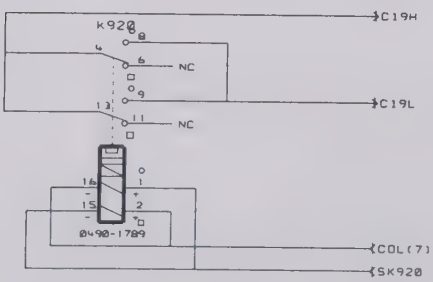
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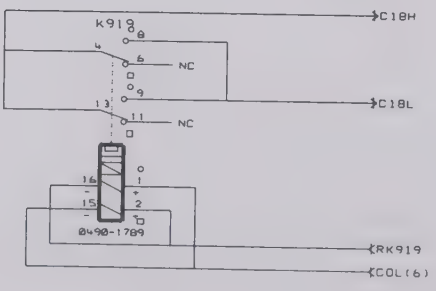
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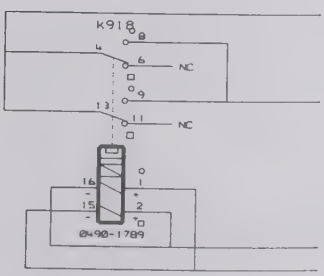
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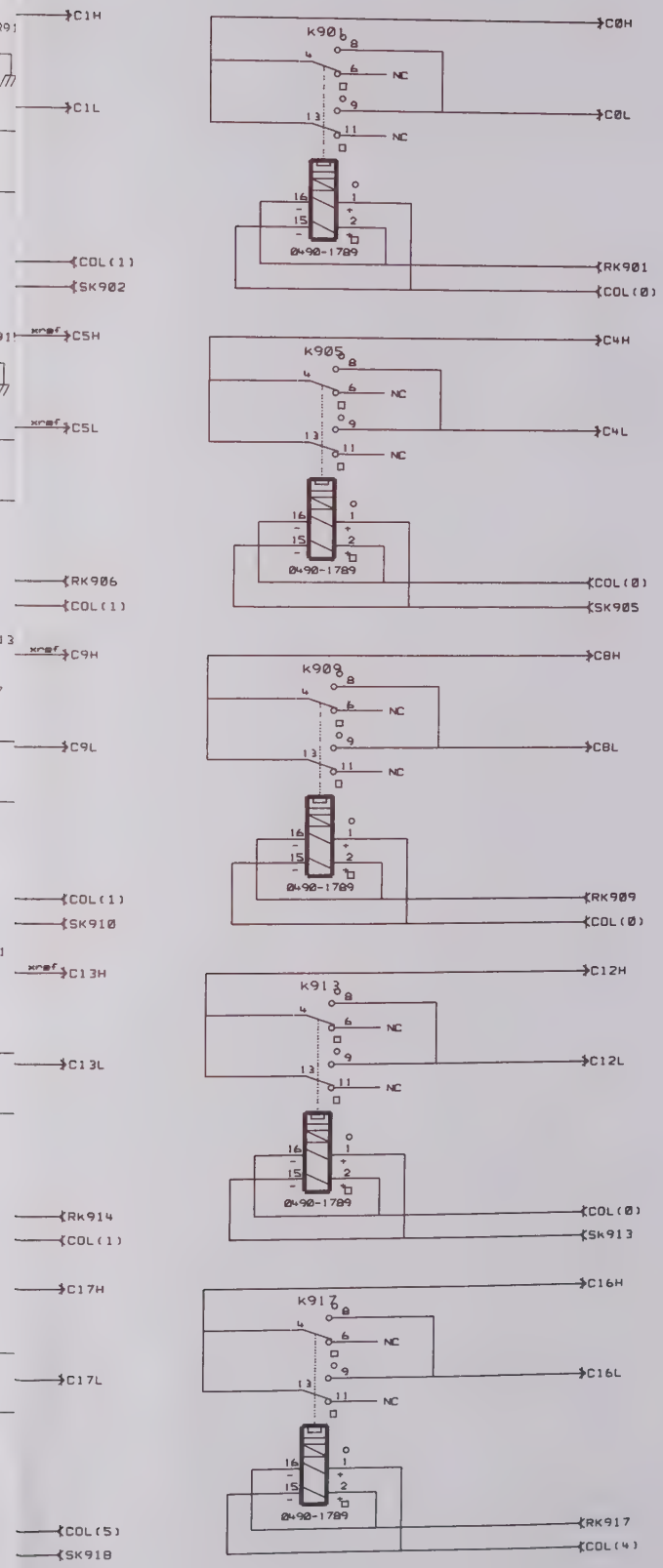
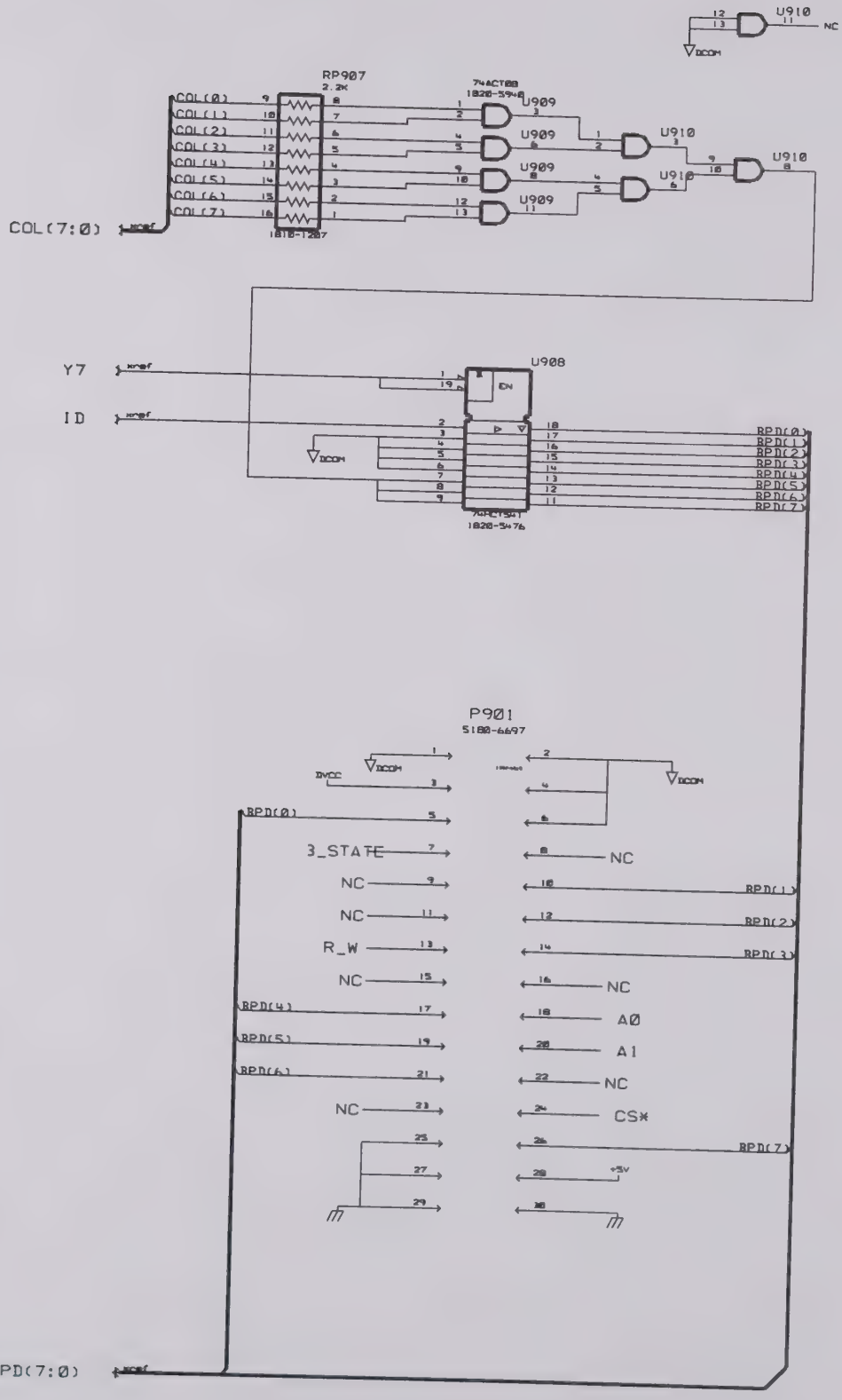


Agilent 44471D 20-Channel GP Relay Module
Schematics -- Sheet 3 of 4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COL(7)
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RPD(5)
RPD(6)
RPD(7)
P901
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R_W
NC
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A1
CS*
+5V
BPD(7:0)

J901
1252-1575

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A4 C2L	C4 C2H	E4 C1H
A6 C3L	C6 C3H	E6 C4L
A8 C5L	C8 C5H	E8 C4H
A10 C6L	C10 C6H	E10 C7L
A12 C8L	C12 C8H	E12 C7H
A14 C9L	C14 C9H	E14 NC
A16 NC	C16 NC	E16 NC
A18 C10L	C18 C10H	E18 C11L
A20 C12L	C20 C12H	E20 C11H
A22 C13L	C22 C13H	E22 C14L
A24 C15L	C24 C15H	E24 C14H
A26 C16L	C26 C16H	E26 C17L
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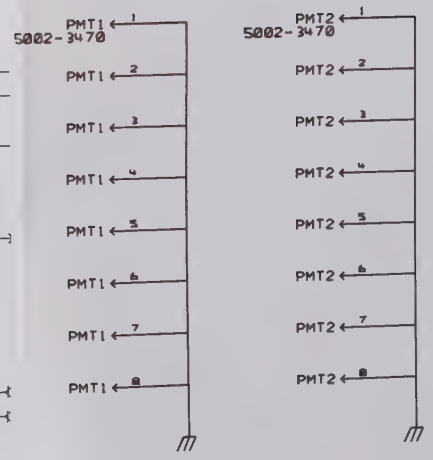

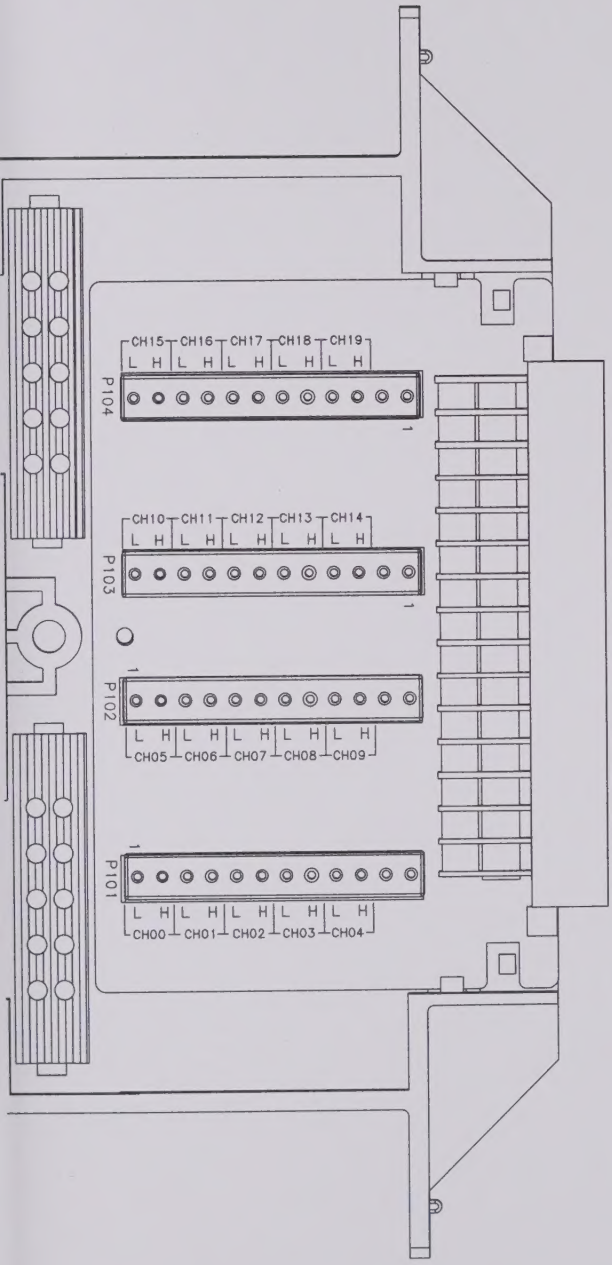
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CH05 CH06 CH07 CH08 CH09
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CH00 CH01 CH02 CH03 CH04
P101

J101
1252-1577

0360-2624

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C2	C0H	2	P101
E2	C1L	3	P101
E4	C1H	4	P101
A4	C2L	5	P101
C4	C2H	6	P101
A6	C3L	7	P101
C6	C3H	8	P101
E6	C4L	9	P101
E8	C4H	10	P101
NC		11	P101
NC		12	P101

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C8	C5H	
A10	C6L	
C10	C6H	
E10	C7L	
E12	C7H	
A12	C8L	
C12	C8H	
A14	C9L	
C14	C9H	
	NC	
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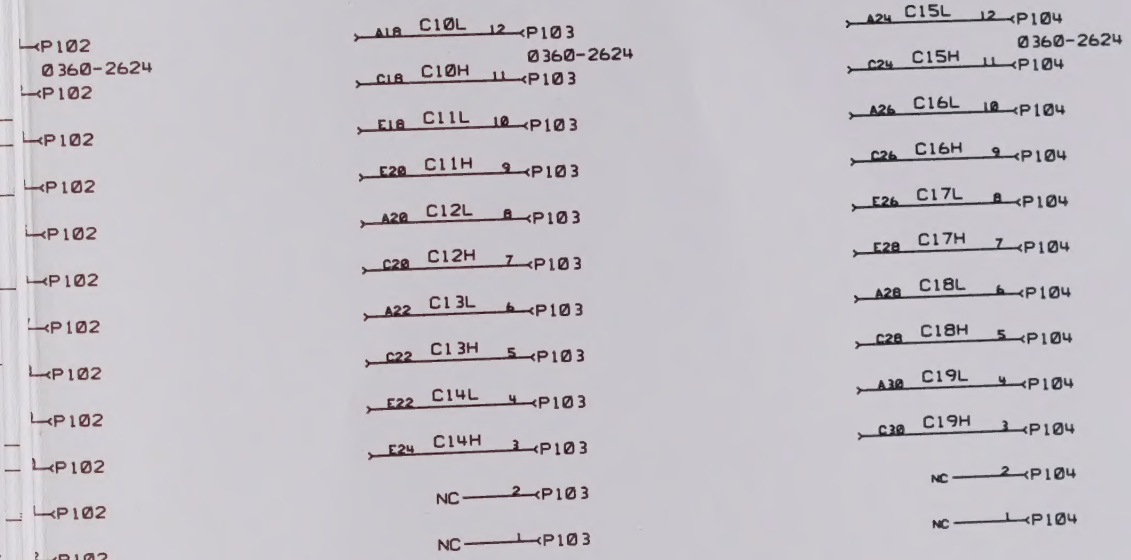

Agilent 44481B Screw Terminal Block Components Locator & Schematics

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